EPA/ROD/R01-95/105
1995

EPA Superfund
Record of Decision:

LORING AIR FORCE BASE
EPA ID: ME9570024522
OU 01
LIMESTONE, ME
09/20/1995

Text:

DECLARATION FOR THE RECORD OF DECISION

SITE NAME AND LOCATION

Loring Air Force Base (LAFB) Operable Unit 1 (OU 1), the Low Level Waste Disposal Sites (LLRWDS), Limestone, Maine.

STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected No-Action decision for OU 1, at LAFB in Limestone, Maine. OU 1 consists of Areas A-G as i Figure 1-2. This decision document was developed in accordance wit Comprehensive Environmental Response, Compensation, and Liability A (CERCLA) of 1980, as amended by the Superfund Amendments and Reauth Act of 1986, and to the extent practicable, the National Oil and Ha Substances Pollution Contingency Plan (NCP), (USEPA, 1990). It is Administrative Record for the site, which was developed in accordan 113(k) of CERCLA and is available for public review at the Air Forc Agency Office, 5100 Texas Road, Limestone, Maine. The Administrati the LLRWDS, OU 1, includes the memos, letters, reports, and associa developed during the CERCLA response at OU 1 that provide the basis No Action.

The State of Maine Department of Environmental Protection concurs w Action under CERCLA remedy for OU 1.

DESCRIPTION OF THE SELECTED REMEDY

The U.S. Air Force and U.S. Environmental Protection Agency (USEPA) concurrence of the Maine Department of Environmental Protection, ha that no action under CERCLA is necessary to address the contaminati soils, surface water, sediments, and groundwater. Previous respons to radionuclides at OU 1 (Areas A through F) have eliminated the ne a remedial action. OU 1 inorganic groundwater contamination will b a separate Record of Decision, and the petroleum contamination at A addressed separately under the Maine Underground Storage Tank Regul

DECLARATION

Because this No Action Record of Decision does not result in hazard pollutants, or contaminants being left at the site above levels tha unrestricted exposure, pursuant to CERCLA 122(c), no five-year re undertaken.

DECLARATION

The U.S. Air Force and USEPA, with concurrence of the Maine Departm

Environmental Protection, have determined that no remedial action u
is necessary at OU 1.

By: Date:

Department of the Air Force
Alan K. Olsen
Director
Air Force Base Conversion Agency

By: Date:

United States Environmental
Protection Agency
Linda M. Murphy
Director
Waste Management Division
Region I

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1.0 SITE NAME, LOCATION, AND DESCRIPTION

Loring Air Force Base (LAFB), in northeastern Maine, is bordered on east by the Town of Limestone, on the north by the towns of Caswell and on the east by the City of Caribou (Figure 1-1). The base is a miles west of the United States/Canadian border and covers approxim acres. The base was closed September 1994.

LAFB is a National Priorities List (NPL) site. There are currently of concern within LAFB that are under investigation. For purposes and remedial response, the areas of concern at LAFB have been organ several operable units (OUs). This Record of Decision (ROD) addres source areas, surface water, sediment, and groundwater at OU 1, the Radioactive Waste Disposal Sites (LLRWDS). The LLRWDS Areas A thro identified in Figure 1-2 are discussed further in Subsection 5.1.

Because of its primary mission, LAFB personnel were engaged in vari a number of which required the use, handling, storage, and disposal materials and substances. In the past, these materials entered the through accidental spills, leaks in piping, landfilling operations, wastes during fire-training exercises, and the cumulative effects o conducted at the base's flightline and industrial areas. As part o of Defense's (DOD) Installation Restoration Program (IRP), the Air initiated activities to identify, evaluate, and remediate former di containing hazardous substances.

Since initiation of the IRP, the Base has been placed on the U.S. E Protection Agency's (USEPA's) NPL of sites and will be remediated a Federal Facility Agreement (FFA) entered into by U.S. Air Force (US USEPA, and the Maine Department of Environmental Protection (MEDEP)

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2.0 SITE AND INVESTIGATION HISTORY

This section summarizes the uses, response history, and investigati
OU 1.

2.1 LAND USE AND RESPONSE HISTORY

The seven LLRWDS in OU 1 are associated with buildings and operatio
Weapon Storage Area (WSA) (Figure 2-1). The WSA was used for the s
routine maintenance of strategic and conventional weapons from 1952
During the 1950s, weapons inspection and maintenance required disas
direct handling of radioactive materials. By the mid-1950s, weapon
changed, radioactive material was no longer exposed in the new desi
earlier type of weapons were progressively phased out of stockpile
weapons were removed from the WSA in May 1989. Conventional weapon
progressively removed in 1993 in anticipation of base closure, with
conventional weapons removed in December 1993.

Five underground storage tanks (USTs) were installed at the WSA LLR
receive and contain potentially radioactive liquids in the event of
the facilities. USAF records indicated there was never a release o
materials to any of the five USTs. The USTs were excavated and dis
during a removal action in 1994. The USTs were observed to be inta
of their removal (Ogden, 1995).

Low-level dry radioactive wastes (e.g., swipes, butcher paper, tape
clothing, respirator cartridges) from maintenance operations were t
cardboard boxes. From 1954 through 1962, the boxes were reportedly
on-site in two waste disposal trenches. During the 1994 removal ac
waste trenches were delineated, exhumed, and the contents were disp

2.2 INVESTIGATION AND RESPONSE HISTORY

The USAF has followed USEPA guidelines for most of the IRP investig conducted at LAFB since 1983, and for all investigations completed

the IRP investigation process was revised to more closely follow th Contingency Plan (NCP) used by the USEPA (USEPA, 1990).

The investigation history of OU 1 is summarized as follows:

In 1983, a Preliminary Assessment (PA) was performed by d historical hazardous material usage and waste disposal pr (CH2M Hill, 1984).

A Site Inspection (SI) was conducted between 1985 and 198 confirm the presence of contaminants at OU 1 (Roy F. West 1988).

Between 1988 and 1994, Remedial Investigation (RI) activi conducted and a Public Health and Ecological Baseline Ris Assessment (RA) was completed (ABB Environmental Services [ABB-ES], 1995a).

LAFB was added to the NPL in February 1990.

The USAF entered into an FFA in 1991 with the USEPA and MEDEP regarding the cleanup of environmental contaminatio LAFB (FFA, 1991).

In 1994, a removal action was conducted that included exc the five radiological USTs and two waste disposal trenche and contents of the trenches were disposed off-site (Ogde

The FFA was modified in December 1993 to address base clo related issues, such as real property transfer and a revi The FFA was further modified in January 1995 to allow Rem Project Managers to make minor modification to the FFA, s schedule adjustments or removal of petroleum-contaminated the agreement.

Contamination detected at Area G is attributed to fuel oi from a former UST and pipeline, and as such, future remed should be conducted in accordance with State of Maine UST regulations.

3.0 COMMUNITY PARTICIPATION

Throughout LAFB's history, the community has been involved in base USAF, USEPA, and MEDEP have kept the community and other interested apprised of LAFB IRP activities through informational meetings, fac releases, public meetings, site tours, and open houses.

In addition to these activities, during the course of IRP activitie have been regular meetings of the Restoration Advisory Board (RAB) Technical Review Committee). The RAB, chaired by the USAF and a re of the community, is composed of representatives of USEPA, MEDEP, t community, and local officials. The purpose of the RAB meetings ha ensure clear communication with the public, timely transfer of info opportunity for public comment.

The framework for the USAF's approach to community involvement is t Community Relations Plan (CRP), which was released in August 1991 a subsequently revised in May 1995. The CRP outlines the USAF's prog addressing community concerns and keeping citizens informed and inv remedial activities.

Documentation of the reports, memoranda, and correspondence that ar for IRP remedial response decisions are kept in an Administrative R Administrative Record is open and available for public review at th Conversion Agency Office, 5100 Texas Road, Limestone, Maine.

The following is a summary of the activities the USAF has undertake public informed and involved regarding the remedial response at OU

On June 2, 1994, a RAB meeting was held to discuss the OU 1 investigations and the approach for conducting th radioactive waste disposal trench removal action.

An IRP Fact Sheet, explaining activities planned for O in July 1994.

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The USAF published a notice and brief discussion of th removal action in the Aroostook Republican on July 6, Bangor Daily News on July 7, 1994.

From July 11 through August 10, 1994, the USAF held a comment period to accept public input on the Action Me outlining the proposed removal action, and on any othe documents in the Administrative Record. On July 28, 1 personnel and regulatory representatives held a public discuss the Action Memorandum and to accept oral comme

During the removal action, the USAF invited the local the trench removal activities. Information regarding and UST tank removals was made available to representa media.

The USAF published a notice and brief analysis of the in the Bangor Daily News, Aroostook Republican, Fort F Review, and Presque Isle Maine Star-Herald on July 12, recommending No Action under CERCLA as the preferred a for OU 1.

From July 17 through August 16, 1995, the USAF held a comment period to accept public input on the informati in the RI/Baseline Risk Assessment and Proposed Plan, other OU 1 documents in the Administrative Record. On 1995, USAF personnel and regulatory representatives he meeting and hearing to discuss the Proposed Plan and t comments. A transcript of this hearing is included in Comments received during the comment periods and the U response to these comments are included in the Respons Summary in Appendix B.

4.0 SCOPE AND ROLE OF RESPONSE ACTION

The USAF and USEPA have determined that no further Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) ac required at OU 1 because (1) previous response actions conducted at unit have eliminated the need to conduct further remedial action an petroleum contamination at Area G will be effectively addressed und Maine regulations.

USEPA has the authority to revisit the No Action under CERCLA decis LAFB is removed from the NPL. This could occur if future condition an unacceptable risk to human health or the environment would resul to contaminants at OU 1.

5.0 SUMMARY OF SITE CHARACTERISTICS

The investigation process began at LAFB in 1983 as part of the DOD process was revised during 1988 to follow the NCP. Investigations include a 1983 PA performed to investigate past activities at LAFB 1984). An SI was initiated in June 1985 to confirm the presence of OU 1 (Roy F. Weston, Inc., 1988). In addition, RI activities were 1988 through 1994 (ABB-ES, 1995b).

There are seven OU 1 sites, Areas A through G, that were grouped to their proximity in the former WSA (Figure 2-1). With one exception used for low-level radioactive waste disposal. The one exception i was inaccurately identified as a low-level radioactive waste dispos Master Plan during the 1970s and 1980s. Research and the results o shown that Area G was not used for low-level radioactive waste disp Master Plan was corrected in the 1990s. A more complete descriptio be found in Section 4 of the Operable Unit (OU 1) Remedial Investig Volume I (ABB-ES, 1995a).

The site areas comprising OU 1 that potentially received low-level are:

Area A: 5,000-gallon liquid waste disposal UST attached to drains. Building 365 was the strategic weapon component ins laboratory that maintained radioactive components. Potentia included radioactive materials (uranium oxide) and solvents weapon maintenance activities.

Area B: 1,000-gallon liquid waste disposal UST attached to Building 329. Building 329 was used to store tritium contai generated during routine venting of tritium gas during weapo activities at Building 329 was the primary focus of the inve

Area C: 1,000-gallon liquid waste disposal UST and a dry ra disposal trench, Trench C. The UST was attached to former B used to store tritium containers. The waste disposal trench 1950s and possible early 1960s to dispose of small quantitie radioactive waste, primarily uranium oxides. Potential cont

investigated at Area C included tritium generated during rou tritium gas during weapon maintenance activities, and radioa and solvents generated at Area A disposed in Trench C.

Area D: 1,500-gallon liquid waste disposal UST. This UST w floor drains in Buildings 255 and 284, both used for storage containers. Tritium was identified as a potential contamina Area D.

Area E: Dry radioactive waste disposal Trench E, similar to Area C in its history and use. The focus of the Area E inve radioactive materials and solvents from wastes generated at

disposed of in Trench E.

Area F: 1,000-gallon liquid waste disposal UST. This UST w a floor drain in a weapon assembly and maintenance structure Potential contaminants at Area F included radioactive materi assembly and maintenance activities at Building 232.

The five radiological USTs were removed from Areas A, B, C, D, and addition, the contents of both waste trenches (Areas C and E) were disposed off-site in 1994.

Area G is not a radioactive waste disposal site. Building 216, loc a weapon assembly building. There were two 10,000-gallon undergrou tanks located at the west end of Building 216. In 1991, both tanks During replacement of the tanks, contaminated subsurface soil, attr from the tanks or piping, was observed. A former underground fuel supplied the 10,000-gallon tanks, traverses Area G. The pipeline i Investigations at Area G have detected solvents and fuel oil in soi

Other investigations and remedial actions have occurred at the WSA the PA and RI programs. The five radiological USTs were removed in of a removal action (Ogden, 1995). All five of the tanks were repo (i.e., not leaking). Based on analysis of UST content samples and samples collected following UST removal, the Radioisotope Committee acknowledged, through verbal agreement, clean closure of the radiol Wipe samples from the building floor drains and the cut end of the UST were also analyzed and reported to be free of radioactive conta

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During the 1994 removal actions, the dry radioactive wastes dispose at Areas C and E were also removed. The contents of both trenches delineated, analyzed, exhumed, and disposed off-site. Analysis of samples collected after trench excavation indicated that the radioa successfully removed from both trenches.

In addition to characterizing the sites, radiological building deco were conducted at 56 weapon storage and maintenance structures loca WSA. No radioactivity above background levels was reported in the structures.

The University of Maine, on behalf of the MEDEP, conducted supporti radiological investigations to evaluate the possible presence of un undocumented radioactive waste disposal sites within the WSA. Univ personnel performed radiological surveys and laboratory analysis of surface water, and sediment samples from OU 1 and vicinity. Their compared to off-site background samples and data from across the St The comparisons indicated that levels of radioactivity across the e at background levels, and the study did not identify any undocument waste disposaI areas. The University of Maine data were not utiliz specific background values for the agreed-upon radionuclides of con in the RI. However, the University of Maine was involved in the re the establishment of these background concentrations developed duri

The following subsections present contamination assessments for var environmental media at OU 1. A more detailed discussion of the con assessment is presented in Section 4 of the RI Report (ABB-ES, 1995

5.1 ANALYTICAL CHEMISTRY ISSUES

In order to better evaluate the nature and distribution of detected three issues which require preliminary discussion. These include:

effects of turbidity on groundwater sample inorganic r

the occurrence of Radium (Ra)-226

radioactive isotope analytical results

Each of these topics is discussed in the following paragraphs.

Turbidity. Inorganics analytes were detected at varying levels abo background concentrations in bedrock monitoring wells at OU 1. Ino also detected in the two overburden wells. Background concentratio in overburden and bedrock groundwater are currently being reassesse OU 12 basewide groundwater RI. Concentrations of inorganics in gro OU 1 will be compared to the OU 12 background concentrations upon a acceptance of those levels. Problems identified during this re-eva groundwater inorganic data will be addressed in the OU 12 ROD. As current and past OU 12 background bedrock and overburden groundwate and total inorganic analyses, the amount of turbidity in a sample c inorganic concentrations reported by the laboratory. Inorganic con typically decrease in the filtered (dissolved) samples, as compared (total) samples. Turbidity is often generated during sample collec bedrock and overburden monitoring wells.

Soil samples from OU 1, the former radiological UST liquids, and wa from the LLRWDS trenches did not contain inorganic concentrations i source areas. Inorganic concentrations in OU 1 groundwater are att natural occurrence, background variation, and/or impacts of turbidi

Occurrence of Ra-226. Ra-226, one of the most abundant naturally o radioactive isotopes, was detected in 80 out of 108 soil samples th The site-related Ra-226 data have been compared to two sets of off- sample concentrations that were developed in 1993 and 1994, respect soil samples, collected in 1993 and before, are compared with the 1 concentrations, no exceedances of background are observed. If the site soil samples are compared with the 1994 background concentrati exceedances of background area observed. However, the exceedances background values are a result of analytical method changes between The reporting limit, or minimum detectable activity, was lower for background sample analyses due to increased analytical sensitivity. data reported in 1994 therefore had lower and more reliable values

background data, with the result that samples collected in 1993 and the lower 1994 background values. Based on this fact, and the wide occurrence of Ra-226, Ra-226 detected at OU 1 is believed to be nat

Radioactive Isotope Analytical Results. During the RI, several ana regarding the quantification and identification of radioactive isot Issues associated with the analysis for Uranium (U)-235, Americium Neptunium (Np)-237 are discussed in the following paragraphs. For explanation of the specific technical issues associated with the ra analytical program, refer to the OU 1 RI (ABB-ES, 1995a).

Gamma spectroscopy U-235 results are considered questionable due to interference caused by Ra-226. U-235 analyzed by alpha spectroscop subject to this interference and provided more accurate data.

Am-241 was detected once in a surface soil sample at Area A. Am-24 an alpha-emitting isotope accompanied by low energy gamma rays, how gamma energy is subject to analytical interferences. The laborator peak used to identify and quantify Am-241 in this sample had a bad which indicated an interference. Therefore, the Am-241 result is c

Np-237 is also primarily an alpha-emitting isotope accompanied by l gamma rays. During the analysis for Np-237 by gamma spectroscopy, were noted by the laboratory, thereby calling into question the ide quantitation of this isotope. Therefore, the identification and qu Np-237 detected by gamma spectroscopy in sediments associated with Butterfield Brook, and East Loring Lake are questionable.

5.2 SUMMARY OF CONTAMINANTS DETECTED

Results of the RI sampling and analysis are briefly summarized in t paragraphs. Results are presented for the radiological USTs and wa trenches first, followed by additional results for each site area.

Radiological USTs. Essentially no contaminants were detected in li or scrape samples collected from the five USTs at Areas A, B, C, D, of confirmatory soil samples collected from the bottom of the UST e did not detect contamination indicative of a source.

Waste Disposal Trenches. Radiological contamination (enriched uran detected in samples collected from the waste disposal trenches at A Subsequently, removal actions were performed in both trenches in 19

Confirmatory samples collected from the limits of the trench excava the removal action indicate that radioactive waste was successfully both Trench C and E.

Arsenic was detected above background in only one of 18, closely gr confirmatory soil samples at Trench E. Arsenic is not a documented associated with OU 1. Detection of arsenic in Area E may be attrib rodenticides used to control burrowing animals at the trench locati

Area A. Polyaromatic hydrocarbons (PAHs), pesticides, polychlorina (PCBs), lead, and zinc were detected above background in Area A sur PAHs, PCBs, and metals in surface soil are attributable to non-poin and runoff from nearby parking areas, roads, and former operational detection of pesticides is consistent with the compounds and concen at other OUs at LAFB. The presence of these compounds is a result basewide use of pesticides.

Radiological analyses detected above background levels in Area A so sediments were Am-241, Np-237, Ra-226, U-235, Thorium (Th)-231, and Am-241, Np-237, and U-235 detections are suspect due to analytical identification and quantitation as discussed in Subsection 5.1. Th Th-231 and Th-234 are considered to be naturally occurring. Ra-226 naturally occurring radionuclide and was detected in nearly all OU

Concentrations of aluminum, chromium, manganese, and nickel exceede Safe Drinking Water Act Maximum Contaminant Levels (MCLs) and MEDEP Maximum Exposure Guidelines (MEGs). These inorganics are naturally and have not been identified as site-related. The detection of the background in OU 1 groundwater is assumed to be a result of sample Tritiurn was detected in one groundwater sample at a level approxim lower than the drinking water standard.

Area B. In general, detected volatile organic compounds (VOCs), se organic compounds (SVOCs), pesticides, and inorganics were below ba levels or at low estimated concentrations. No PCBs were detected a U-235, Th-231, and Ra-226 were detected above background levels in B. As discussed previously, the identification and quantitation of due to analytical interferences. Th-231 is believed to be naturall

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Area B. The Ra-226 detection at Area B is typical of Ra-226 concen throughout OU 1.

Inorganics (iron, chromium, lead, manganese, and nickel) were detec groundwater above MCLs and MEGs at Area B. These detections are li associated with turbidity.

Area C. Three inorganic analyses (calcium, mercury, and sodium) we above background in Area C soil. These analytes were detected at e concentrations except for calcium, which is considered to be an ess

U-235, Th-234, and Ra-226 were detected in soil at concentrations a concentrations. These radionuclides are naturally occurring and th above background levels is attributable to natural differences in b analytical variability. The detections of U-235 are suspect due to difficulties in identification and quantification.

Trace or estimated levels of VOCs and pesticides were detected in g samples collected in 1993, but were not reported in 1994 samples. (aluminum, lead, and manganese) were detected in groundwater; howev case of other groundwater samples, the concentrations likely reflec and the effect of sample turbidity. Th-232 and U-234 were detected in groundwater at Area C. Both of these radionuclides are naturall Tritium was detected in one groundwater sample at a level approxima lower than the drinking water standard.

Area D. Other than the detection of three pesticide compounds at o background levels, no organic or inorganic contamination was detect Area D. Ra-226 was the only radionuclide detected in soil at Area concentration above background levels.

Aluminum, lead, and manganese were detected in Area D groundwater a concentrations greater than MCLs and MEGs. However, the groundwate were turbid. Th-230, U-234, and U-238 were detected above backgrou 1993, but not in 1994. These are naturally occurring radionuclides

Area E. PAHs were detected below LAFB background levels in surface drainage swale at Area E. The occurrence of these compounds is att non-point source runoff from the former operations at Area E. No o contaminants were detected in soil at Area E. Lead, silver, and so

detected above background concentrations in surface soil samples. cadmium (in five samples), zinc (in three samples), and arsenic, co detected above background values. The arsenic and lead detections localized in a trench confirmatory sample. Their detection is not widespread residual contamination.

U-235, Ra-226, Ra-228, Th-228, and Th-231 were detected above backg in Area E soils. These isotopes are naturally occurring and were p concentrations that slightly exceeded LAFB background concentration

Aluminum, chromium, lead, and manganese were detected in groundwate at Area E at concentrations exceeding MCLs and MEGs. As with the o throughout the OU, the concentrations of inorganics are assumed to of turbidity in the samples. Th-230, U-234, and U-238 were detecte in 1993 at estimated concentrations above background levels. In th groundwater sampling round, Th-228, Th-230, and Th-232 (estimated c were detected above background levels. These analyses are naturall their detection above background levels is attributable to analytic differences in natural background concentrations. Tritium was dete groundwater sample at a level approximately 100 times lower than th standard.

Area F. No organic compounds were detected in soils at Area F othe detection of a compound believed to be a laboratory contaminant. P compounds were detected at concentrations below, or slightly exceed concentrations. The occurrence of these compounds is attributable application of pesticides at LAFB. Arsenic, lead, and zinc were de estimated concentrations and were slightly above background levels. (Pa)-234, Th-234, and U-235 were detected in soils at Area F. Th-2 U-235 are naturally occurring radionuclides. The U-235 result is s analytical interferences.

No organic compounds were detected in groundwater at concentrations or MEGs at Area F. Two pesticide compounds were detected in the 19 sampling, but were not reported in 1994. Aluminum is the only inor detected above MCLs and MEGs in groundwater at Area F. In 1994, al detected below the MEG in the same well. No radionuclides were det background concentrations in groundwater at Area F.

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Area G. No VOCs were detected in surface soil. PAHs were detected surface soil samples. Total PAH concentrations exceeded background location at the head of a drainage swale that receives runoff from area, from Building 216 floor drains, and is located adjacent to an the fuel pipeline and two fuel oil USTs. In general, inorganics, p lead, sodium, and zinc, were detected sightly above background conc several samples at Area G. Most of these samples showed detections inorganic analytes. One sample, located at the head of the drainag receives runoff from much of the site, contained 11 inorganic analy background concentrations.

TCE and total xylenes were detected once at estimated concentration soil. The concentration of TCE is not indicative of a potential so xylenes in subsurface soil had been detected in an area where fuel- contaminants had been detected by field screening. No PCBs were fo subsurface soils at Area G. One inorganic compound (sodium) was de background levels.

Pa-234, Th-231, and U-235 were detected in soils at Area G. Th-234 Pa-234 are naturally occurring radionuclides. The U-235 result is to interferences in quantitation and identification. Ra-226 is an occurring radionuclide and was detected in nearly all OU 1 samples.

ln 1993, trichloroethene (TCE) was detected above its MCL and MEG i downgradient groundwater sample. However, in 1994, TCE concentrati groundwater were below regulatory limits. Several PAHs, indicative contaminants, were detected at estimated concentrations in a downgr monitoring well location. Pesticides were detected at low, estimat in the samples in 1993, and only in deep bedrock groundwater in 199 occurrence of these compounds is attributable to the widespread app pesticides at LAFB.

U-234, U-235, Ra-226, Th-230, and Th-232 were detected in groundwa

background concentrations. These isotopes are naturally occurring detected sporadically during the groundwater sampling rounds. The above background levels is likely the result of natural background analytical variability. Tritium was detected in one groundwater s approximately 100 times lower than the drinking water standard.

6.0 SUMMARY OF SITE RISKS

Human health and ecological risk assessments were conducted to esti probability and magnitude of potential adverse human health and env effects from exposure to contaminants at OU 1. The risk assessment four-step process:

1) contaminant identification, which identified those hazardous su were of significant concern;

2) exposure assessment, which identified actual or potential expos characterized potentially exposed populations and receptors, an the magnitude of possible exposure;

3) toxicity assessment, which considered the types and severity of effects associated with exposure to hazardous substances; and

4) risk characterization, which integrated the three earlier steps potential risks posed by hazardous substances at the site, incl carcinogenic and non-carcinogenic risks.

The methodologies of the baseline human health and ecological risk the site areas are discussed below, followed by a summary of the co

6.1 HUMAN HEALTH RISK ASSESSMENT

For the purpose of the human health baseline risk assessment, the a were segregated as Area A and Areas B through G. Area A is situate Loring Lake (see Figure 1-1) and is isolated from the remaining OU are located to the east of the lake. The focus of the risk assessm non-radiological (i.e., chemical) and radiological contaminants in surface water, and groundwater. During the initial evaluation of d of potential concern (CPCs) were identified. The rationale for exc compounds is included in Tables 6-1 and 6-2. The CPCs were selecte potential hazards based on toxicity, concentration, frequency of de and persistence in the environment. A summary of the health effect each CPC can be found in the RI Report (ABB-ES, 1995a).

TABLE 6 - 1
NON-RADIOLOGICAL ANALYTES OF POTENTIAL CONCERN
RISK ASSESSMENT

OPERABLE UNIT 1 RECORD
LORING AIR FORCE

	Range of SQLs	Frequency of Detection	Minimum Detected Concentration	MEG	CPC?	Notes
Area A: Surface Soil* (0-2 feet bgs) (mg/kg)						
SEMIVOLATILE ORGANIC COMPOUNDS						
Acenaphthene	0.3600 -	0.4100		-	Yes	Class 1
Anthracene	0.3600 -	0.4100		-	Yes	Class 1
Benzo(a)Anthracene	0.3600 -	0.3600		-	-	Yes
Benzo(a)Pyrene	0.3600 -	0.4100		-	Yes	
Benzo(b,k)Fluoranthene	0.3600 -	0.4100		-	Yes	
Carbazole	0.3600 -	0.4100		-	No	Toxicity Screening2
Chrysene	0.3600 -	0.3600		-	Yes	Class1
Fluoranthene	0.3600 -	0.3600		-	Yes	Class1
Fluorene	0.3600 -	0.4100		Yes	Class1	
Indeno(1,2,3-c,d)Pyrene	0.3600 -	0.4100		-	-	Yes
Phenanthrene	0.3600 -	0.3600		-	Yes	Class1
Pyrene	0.3600 -	0.3600		Yes	Class1	
PESTICIDES/PCBs						
4,4'-DDE				No	Toxicity Screening2	
4,4'-DDT	0.0036 -	0.0036		-	No	Toxicity Screening2
Aroclor-1260	0.0360 -	0.0380		-	Yes	
Dieldrin	0.0036 -	0.0041		-	No	Toxicity Screening2
Endosulfan Sulfate	0.0036 -	0.0036		-	-	No Toxicity Screening2
Endrin	0.0036 -	0.0041		-	No	Toxicity Screening2
Endrin Aldehyde	0.0036 -	0.0038		-	-	No Toxicity Screening2
Endrin Ketone	0.0036 -	0.0041		-	No	Toxicity Screening2

	Methoxychlor			0.0180	-	0.0180		
-	No	Toxicity Screening2						
	gamma-Chlordane			0.0018	-	0.0021		
-	-	No	Toxicity Screening2					
	INORGANIC ANALYTES							
	Aluminum							
No	Background3							
	Arsenic							
Background3								
	Barium							
Background3								
	Beryllium			0.9300	-	1.0000		
No	Background3							
	Calcium							
Background3, Essential Nutrient4								
	Chromium							
Background3								
	Cobalt							
Background3								
	Copper							
Background3								
	Iron							
Background3								
	Lead							
State5								
	Magnesium							
No	Background3, Essential Nutrient4							
	Manganese							
Background3								
	Nickel							
Background3								
	Potassium							
Background3, Essential Nutrient4								
	Sodium							
Background3, Essential Nutrient4								
	Vanadium							
Background3								
	Zinc							
	Areas B-G: Surface Soil* (0-2 feet bgs) (mg/kg)							
	SEMIVOLATILE ORGANIC COMPOUNDS							
	Benzo(a)Anthracene			0.3600	-	0.4700		
-	-	Yes						
	Benzo(a)Pyrene			0.3600	-	0.4700		
-	Yes							
	Benzo(b,k)Fluoranthene			0.3600	-	0.4700		
-	-	Yes						
	Butylbenzylothalate			0.3500	-	0.4700		
-	-	No	Toxicity Screening2					
	Chrysene			0.3600	-	0.4700		
-	Yes	Class1						
	Di-n-butylphthalate			0.3500	-	0.4700		
-	-	No	Toxicity Screening2					
	Fluoranthene			0.3600	-	0.4700		
-	Yes	Class1						
	Phenanthrene			0.3500	-	0.4700		
-	Yes	Class1						
	Pyrene			0.3600	-	0.4700		
-	Yes	Class1						

	bis(2-Chloroisopropyl)ether	0.3500	-	0.4700			
NDB	-	-	No	Toxicity Screening2			
	bis(2-Ethylhexyl)phthalate	0.3500	-	0.4700			
-	-	No	Toxicity Screening2				
	PESTICIDES/PCBs						
	4,4'-DDD	0.0036	-	0.0042			
-	Yes	Class1					
	4,4'-DDE	0.0037	-	0.0042			
-	Yes	Class1					
	4,4'-DDT	0.0036	-	0.0042			
-	Yes						
	Aldrin	0.0019	-	0.0025			
-	No	Toxicity Screening2					
	Aroclor-1260	0.0360	-	0.0480			
-	Yes						
	Dieldrin	0.0036	-	0.0048			
-	No	Toxicity Screening2					
	Endosulfan I	0.0019	-	0.0025			
-	No	Toxicity Screening2					
	Endosulfan II	0.0036	-	0.0048			
-	No	Toxicity Screening2					
	Endosulfan Sulfate	0.0036	-	0.0048			
-	-	No	Toxicity Screening2				
	Endrin	0.0035	-	0.0048			
-	No	Toxicity Screening2					
	Endrin Aldehyde	0.0035	-	0.0048			
-	-	No	Toxicity Screening2				
	Heptachlor	0.0018	-	0.0025			
-	No	Toxicity Screening2					
	Heptachlor Epoxide	0.0018	-	0.0025			
-	-	No	Toxicity Screening2				
	Methoxychlor	0.0180	-	0.0250			
-	-	No	Toxicity Screening2				
	alpha-Chlordane	0.0019	-	0.0025			
-	-	Yes					
	delta-BHC	0.0019	-	0.0025			
-	No	Toxicity Value6					
	gamma-Chlordane	0.0019	-	0.0025			
-	-	Yes					

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TABLE 6-1
NON-RADIOLOGICAL ANALYTES OF POTENTIAL CONCERN
RISK ASSESSMENT

OPERABLE UNIT 1 RECORD
LORING AIR FORCE

	Range of SQLs			Frequency of Detection	Minimum Detected Concentration		
MEG	CPC?	Notes					

INORGANIC ANALYTES
Aluminum
No Background3
Arsenic
Background3
Barium
Background3
Beryllium 0.24 - 1.2
No Background3
Calcium
No Background3, Essential Nutrient4
Chromium
No Background3
Cobalt 10/ 10
18.5 - - No Background3
Copper
Background3
Iron
No Background3
Lead 14.9 - 17
State5
Magnesium
No Background3, Essential Nutrient4
Manganese
No Background3
Mercury 0.11 - 0.14
Yes
Nickel
Background3
Potassium
No Background3, Essential Nutrient4
Silver 0.85 - 1.5
Sodium 37.6 - 57
No Essential Nutrient4
Vanadium
Background3
Zinc

Areas B-G: Surface Soil Sample JSS-2880* (0-1 bgs) (mg/kg)

SEMIVOLATILE ORGANIC COMPOUNDS
2-Methylnaphthalene
Yes
Anthracene
Class1
Fluoranthene
Class1
Naphthalene
Class1
Phenanthrene
Class1
Pyrene
Class1

PESTICIDES/PCBs (mg/kg)
4,4'-DDT
Aldrin
Yes
Endosulfan I
No Toxicity Screening2

	Endosulfan II	
Toxicity Screening2		
	Endosulfan Sulfate	
No	Toxicity Screening2	
	Endrin	
No	Toxicity Screening2	
	Endrin Ketone	
No	Toxicity Screening2	
	Heptachlor Epoxide	
Yes		
	alpha-Chlordane	
Yes		
	beta-BHC	
Yes		
	delta-BHC	
Yes	Class1, Toxicity Value6	
	gamma-BHC (Lindane)	
-	Yes	
	gamma-Chlordane	
-	Yes	
	INORGANIC ANALYTES	
	Aluminum	
No	Background3	
	Arsenic	
Background3		
	Barium	
	Cadmium	
	Calcium	
No	Background3, Essential Nutrient4	
	Chromium	
	Cobalt	
Background3		
	Copper	
	Iron	
Background3		
	Lead	
State5		
	Magnesium	
No	Essential Nutrient4	
	Manganese	
Background3		
	Mercury	
	Nickel	
Background3		
	Potassium	
Background3, Essential Nutrient4		
	Sodium	
Essential Nutrient4		
	Vanadium	
	Zinc	

NON-RADIOLOGICAL ANALYTES OF POTENTIAL CONCERN
RISK ASSESSMENT

OPERABLE UNIT 1 RECORD
LORING AIR FORCE

	Range of SQLs	Frequency of Detection	Minimum Detected Concentration	MEG	CPC?	Notes
Areas B-G: Subsurface Soil* (0-10 feet bgs) (mg/kg)						
VOLATILE ORGANIC COMPOUNDS						
1,2-Dichloroethene (total)	0.011 -	0.014		-	-	No Frequency7
2-Butanone	0.011 -	0.014		-	No	Frequency7
Acetone	0.011 -	0.044		No	Frequency7	
Methylene Chloride	0.006 -	0.068		-	No	Toxicity Screening2
Toluene	0.011 -	0.014		No	Frequency7	
Trichloroethene	0.011 -	0.014		-	No	Toxicity Screening2
SEMIVOLATILE ORGANIC COMPOUNDS						
Benzo(a)Anthracene	0.36 -	0.47		-	No	Toxicity Screening2, Frequency7
Benzo(a)Pyrene	0.36 -	0.47		-	No	Toxicity Screening2, Frequency7
Benzo(b,k)Fluoranthene	0.36 -	0.47		-	No	Toxicity Screening2
Butylbenzylphthalate	0.35 -	0.47		-	No	Toxicity Screening2
Chrysene	0.36 -	0.47		No	Toxicity Screening2	
Di-n-butylphthalate	0.35 -	0.47		-	No	Frequency7
Fluoranthene	0.36 -	0.47		-	No	Toxicity Screening2
Phenanthrene	0.35 -	0.47		-	No	Toxicity Screening2, Frequency7
Pyrene	0.36 -	0.47		No	Toxicity Screening2	
bis(2-Chloroisopropyl)ether	0.35 -	0.47		-	-	No Frequency7
bis(2-Ethylhexyl)phthalate	0.35 -	0.47		-	No	Toxicity Screening2
PESTICIDES/PCBs						
4,4'-DDD	0.0036 -	0.019		-	No	Toxicity Screening2
4,4'-DDE	0.0036 -	0.019		-	No	Toxicity Screening2
4,4'-DDT	0.0036 -	0.019		-	No	Toxicity Screening2
Aldrin	0.0018 -	0.0098		-	No	Frequency7

	Arochlor-1260	0.036	-	0.19	-	Yes
	Dieldrin	0.0036	-	0.019	-	No Toxicity Screening2
	Endosulfan I	0.0018	-	0.0098	-	No Toxicity Screening2
	Endosulfan II	0.0036	-	0.019	-	No Toxicity Screening2, Frequency7
	Endosulfan Sulfate	0.0036	-	0.019	-	No Toxicity Screening2
	Endrin	0.0035	-	0.019	-	No Toxicity Screening2
	Endrin Aldehyde	0.0035	-	0.019	-	No Toxicity Screening2
	Heptachlor	0.0018	-	0.0098	-	No Toxicity Screening2, Frequency7
	Heptachlor Epoxide	0.0018	-	0.0098	-	No Toxicity Screening2
	Methoxychlor	0.018	-	0.098	-	No Toxicity Screening2
	alpha-Chlordane	0.0018	-	0.0098	-	No Toxicity Screening2
	delta-BHC	0.0018	-	0.0098	-	No Toxicity Value6
	gamma-Chlordane	0.0018	-	0.0098	-	No Toxicity Screening2
	INORGANIC ANALYTES					
	Aluminum					No Background3
	Antimony	7.8	-	20	No	Frequency7
	Arsenic					
	Barium	50	-	50	Background3	
	Beryllium	0.24	-	2	Background3	
	Cadmium	1.1	-	2	Toxicity Screening2	
	Calcium	2000	-	2000	-	No Background3, Essential Nutrient4
	Chromium				Background3	
	Cobalt	20	-	20	Toxicity Screening2	
	Copper				Background3	
	Iron				No	Background3
	Lead	13.6	-	17	State5	
	Magnesium				No	Background3, Essential Nutrient4
	Manganese				No	Background3
	Mercury	0.11	-	0.2	No	Frequency7
	Nickel				Background3	
	Potassium	2000	-	2000	No	Essential Nutrient4

Silver 0.85 - 3
Frequency7
Sodium 37.6 - 2000
No Essential Nutrient4
Uranium (total U-234, U-235, U-238)
- No Toxicity Screening2
Vanadium
Background3
Zinc
Background3

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TABLE 6-1
NON-RADIOLOGICAL ANALYTES OF POTENTIAL CONCERN
RISK ASSESSMENT

OPERABLE UNIT 1 RECORD
LORING AIR FORCE

	Range of SQLs	Frequency of Detection	Minimum Detected Concentration	MEG	CPC?	Notes
Area A: 1994 Groundwater* (mg/L)						
SEMIVOLATILE ORGANIC COMPOUNDS						
Phenol						Toxicity Screening2
INORGANIC ANALYTES						
Aluminum					No	Toxicity Value6
Barium					No	Toxicity Screening2
Calcium						Essential Nutrient4
Chromium					Yes	
Copper					No	Toxicity Screening2
Iron						
Lead				0.02	No	State5
Magnesium						Essential Nutrient4
Manganese					Yes	
Nickel					Yes	
Potassium						Essential Nutrient4
Sodium						

Essential Nutrient4
Zinc
Toxicity Screening2

Area A: 1993 Groundwater* (mg/L)

VOLATILE ORGANIC COMPOUNDS
Total Xylenes
No Toxicity Screening2

PESTICIDES/PCBs
Endosulfan Sulfate
- No Toxicity Screening2
Endrin Aldehyde
- No Toxicity Screening2
Heptachlor
0.00008 No Toxicity Screening2

INORGANIC ANALYTES
Aluminum
No Toxicity Value6
Arsenic
Yes
Calcium
Essential Nutrient4
Chromium
0.1 Yes
Copper
No Toxicity Screening4
Iron
Lead
0.02 No State5
Magnesium
Essential Nutrient4
Manganese
Yes
Nickel
Yes
Potassium
Essential Nutrient4
Sodium
Essential Nutrient4
Zinc
Toxicity Screening2

Areas B-F: 1994 Bedrock Groundwater* (mg/L)

VOLATILE COMPOUNDS
4-Methyl-2-pentanone 0.002 - 0.002
- - No Toxicity Screening2
Total Xylenes 0.002 - 0.002
10 0.6 No Toxicity Screening2
Trichloroethene 0.002 - 0.002
0.005 0.005 No Toxicity Screening2

SEMIVOLATILE ORGANIC COMPOUNDS
2-Methylnaphthalene 0.01 - 0.01
- - No Toxicity Screening2
Di-n-butylphthalate 0.01 - 0.01
0.22 No Toxicity Screening2
Phenol 0.01 - 0.01

No Toxicity Screening2

PESTICIDES/PCBs
4,4'-DDT 0.00001 - 0.00001
- 0.00083 No Toxicity Screening2

INORGANIC ANALYTES
Aluminum
1.43 No Toxicity Value6
Arsenic 0.0015 - 0.0015
0.05 - Yes
Barium
No Toxicity Screening2
Beryllium 0.0003 - 0.0003
0.004 - Yes
Calcium
No Essential Nutrient4
Chromium 0.0074 - 0.0074
0.1 0.1 Yes
Copper 0.0086 - 0.0086
1.3T - No Toxicity Screening2
Iron
Yes
Lead 0.0007 - 0.0007
0.015T 0.02 Yes State5
Magnesium
No Essential Nutrient4
Manganese
0.2 Yes
Mercury 0.0001 - 0.0001
0.002 0.002 No Toxicity Screening2
Nickel 0.0226 - 0.0226
0.15 No Toxicity Screening2
Potassium
No Essential Nutrient4
Sodium
No Essential Nutrient4
Vanadium 0.012 - 0.012
- No Toxicity Screening2
Zinc 0.0187 - 0.0618
- No Toxicity Screening2

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TABLE 6-1
NON-RADIOLOGICAL ANALYTES OF POTENTIAL CONCERN
RISK ASSESSMENT

OPERABLE UNIT 1 RECORD
LORING AIR FORCE

	Range of SQLs		Frequency of Detection		Minimum Detected Concentration		
No	Toxicity Screening2						
	PESTICIDES/PCBs						
	4,4'-DDT	0.00001 -	0.00001	-	0.00083	No	Toxicity Screening2
	INORGANIC ANALYTES						
	Aluminum						
1.43	No	Toxicity Value6					
	Arsenic	0.0015 -	0.0015	0.05	-	Yes	
	Barium						
No	Toxicity Screening2						
	Beryllium	0.0003 -	0.0003	0.004	-	Yes	
	Calcium						
No	Essential Nutrient4						
	Chromium	0.0074 -	0.0074	0.1	0.1	Yes	
	Copper	0.0086 -	0.0086	1.3T	-	No	Toxicity Screening2
	Iron						
Yes							
	Lead	0.0007 -	0.0007	0.015T	0.02	Yes	State5
	Magnesium						
No	Essential Nutrient4						
	Manganese						
0.2	Yes						
	Mercury	0.0001 -	0.0001	0.002	0.002	No	Toxicity Screening2
	Nickel	0.0226 -	0.0226	0.15	No	Toxicity Screening2	
	Potassium						
No	Essential Nutrient4						
	Sodium						
No	Essential Nutrient4						
	Vanadium	0.012 -	0.012	-	No	Toxicity Screening2	
	Zinc	0.0187 -	0.0618	-	No	Toxicity Screening2	

MEG	CPC?	Notes
		Areas B-F: 1993 Bedrock Groundwater* (mg/L)
		VOLATILE ORGANIC COMPOUNDS
		Chloroform 0.001 - 0.001
0.1	-	No Toxicity Screening2
		Ethylbenzene 0.001 - 0.001
0.7	0.7	No Toxicity Screening2
		Toluene 0.001 - 0.001
1.4	No	Toxicity Screening2
		Total Xylenes 0.002 - 0.002
10	0.6	No Toxicity Screening2
		Trichloroethene 0.001 - 0.001
0.005	0.005	No Toxicity Screening2
		SEMIVOLATILE ORGANIC COMPOUNDS
		4-Nitrophenol 0.025 - 0.025
0.083	No	Toxicity Value6
		Di-n-octylphthalate 0.01 - 0.01
-	No	Toxicity Screening2
		PESTICIDES/PCBs
		4,4'-DDE 0.00002 - 0.00002
NDB	-	- No Toxicity Screening2
		4,4'-DDT 0.00002 - 0.00002
NDB	-	0.00083 No Toxicity Screening2
		Aldrin 0.00001 - 0.00001
-	-	No Toxicity Screening2
		Dieldrin 0.00002 - 0.00002
NDB	-	0.00002 No Toxicity Screening2
		Endosulfan Sulfate 0.00002 - 0.00002
NDB	-	- No Toxicity Screening2
		Heptachlor 0.00001 - 0.00001
NDB	0.0004	0.00008 No Toxicity Screening2
		Heptachlor Epoxide 0.00001 - 0.00001
NDB	0.0002	0.00004 No Toxicity Screening2
		Methoxychlor 0.0001 - 0.0001
NDB	0.04	0.1 No Toxicity Screening2
		alpha-BHC 0.00001 - 0.00001
NDB	-	- No Toxicity Screening2
		alpha-Chlordane 0.00001 - 0.00001
NDB	0.002	0.00027 No Toxicity Screening2
		delta-BHC 0.00001 - 0.00001
NDB	-	- No Toxicity Value6
		gamma-BHC (Lindane) 0.00001 - 0.00001
NDB	0.0002	0.0002 No Toxicity Screening2
		gamma-Chlordane 0.00001 - 0.00001
NDB	0.002	0.00027 No Toxicity Screening2
		INORGANIC ANALYTES
		Aluminum
1.43	No	Toxicity Value6
		Arsenic 0.0052 - 0.0052
0.05	-	Yes
		Barium 0.0162 - 0.135
1.5	No	Toxicity Screening2
		Calcium
No	Essential Nutrient4	
		Chromium 0.0092 - 0.0092

0.1 0.1 Yes
Copper 0.0111 - 0.0111
1.3T - No Toxicity Screening2
Iron
Yes
Lead 0.002 - 0.002
0.015T 0.02 Yes State5
Magnesium
No Essential Nutrient4
Manganese 0.0043 - 0.0043
0.05# 0.2 Yes
Mercury 0.0002 - 0.0002
0.002 0.002 No Toxicity Screening2
Nickel 0.0142 - 0.0142
0.1 0.15 No Toxicity Screening2
Potassium 1.76 - 1.76
No Essential Nutrient4
Sodium
No Essential Nutrient4
Zinc 0.01 - 0.043
No Toxicity Screening2

Areas B-F: 1994 Overburden Groundwater* (mg/L)

INORGANIC ANALYTES
Aluminum
No Toxicity Value6
Arsenic
Yes
Barium
No Toxicity Screening2
Beryllium
Yes
Calcium
Essential Nutrient4
Chromium
Yes
Copper
No Toxicity Screening2
Iron
Lead
Yes State5
Magnesium
Essential Nutrient4
Manganese
Yes
Nickel
No Toxicity Screening2
Potassium
Essential Nutrient4
Sodium
Essential Nutrient4
Vanadium
No Toxicity Screening2
Zinc
Toxicity Screening2

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TABLE 6-1
NON-RADIOLOGICAL ANALYTES OF POTENTIAL CONCERN
RISK ASSESSMENT

OPERABLE UNIT 1 RECORD
LORING AIR FORCE

	Range of SQLs		Frequency of Detection	Minimum Detected Concentration	MEG	CPC?	Notes
Areas B-F: 1993 Overburden Groundwater* (mg/L)							
VOLATILE ORGANIC COMPOUNDS							
Tetrachloroethene					0.003	No	Toxicity Screening2
Toluene					No	Toxicity Screening2	
Total Xylenes					No	Toxicity Screening2	
SEMIVOLATILE ORGANIC COMPOUNDS							
4-Nitrophenol					No	Toxicity Value6	
PESTICIDES/PCBs							
gamma-BHC (Lindane)	0.0002	0.0002	No	Taxicity Screening2			
INORGANIC ANALYTES							
Aluminum					No	Toxicity Value6	
Arsenic					Yes		
Barium					No	Toxicity Screening2	
Calcium					Essential Nutrient4		
Chromium					Yes		
Cobalt					Toxicity Screening2		
Copper					No	Toxicity Screening2	
Iron							
Lead					0.02	Yes	State5
Magnesium					Essential Nutrient4		
Manganese					Yes		
Mercury					0.002	No	Toxicity Screening2
Nickel							

Yes Exceeds MCL and MEG8
Potassium
Essential Nutrient4
Sodium
Essential Nutrient4
Vanadium
Yes
Zinc
Toxicity Screening2

Area G: 1994 Groundwater* (mg/L)

VOLATILE ORGANIC COMPOUNDS
1,1-Dichloroethene (total) 0.002 - 0.002
- - No Toxicity Screening2
2-Hexanone 0.002 - 0.002
- No Toxicity Value6
Acetone 0.002 - 0.004
- No Toxicity Screening2
Benzene 0.002 - 0.002
0.005 0.005 No Toxicity Screening2
Bromoform 0.002 - 0.002
0.1 - No Toxicity Screening2
Chloromethane 0.002 - 0.002
0.003 No Toxicity Screening2
Ethylbenzene 0.002 - 0.002
0.7 0.7 No Toxicity Screening2
Total Xylenes 0.002 - 0.002
10 0.6 No Toxicity Screening2
Trichloroethene 0.002 - 0.002
0.005 0.005 No Toxicity Screening2

SEMIVOLATILE ORGANIC COMPOUNDS
2-Methylnaphthalene 0.01 - 0.01
- No Toxicity Screening2
Acenaphthene 0.01 - 0.01
- No Toxicity Screening2
Anthracene 0.01 - 0.01
- No Toxicity Screening2
Dibenzofuran 0.01 - 0.01
- No Toxicity Screening2
Fluorene 0.01 - 0.01
No Toxicity Screening2
Naphthalene 0.01 - 0.01
- No Toxicity Screening2
Phenanthrene 0.01 - 0.01
- No Toxicity Screening2
Phenol 0.01 - 0.01
No Toxicity Screening2

PESTICIDES/PCBs
Aldrin 0.000005 - 0.000005
NDB - - Yes
Endosulfan Sulfate 0.00001 - 0.00001
NDB - - No Toxicity Screening2
Endrin Aldehyde 0.00001 - 0.00001
NDB - - No Toxicity Screening2
Heptachlor 0.000005 - 0.000005
NDB 0.0004 0.00008 No Toxicity Screening2
alpha-BHC 0.000005 - 0.000005
NDB - - No Toxicity Screening2

INORGANICS
Aluminum
1.43 No Toxicity Value6
Arsenic 0.0015 - 0.0015
0.05 - Yes
Barium
1.5 Yes
Calcium
Essential Nutrient4
Chromium 0.0074 - 0.0074
0.1 0.1 Yes
Copper 0.0086 - 0.0086
1.3T - No Toxicity Screening2
Iron
Yes
Lead 0.0007 - 0.0007
0.015T 0.02 No State5
Magnesium
No Essential Nutrient4
Manganese
0.2 Yes
Potassium
Essential Nutrient4
Sodium
No Essential Nutrient4

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TABLE 6-1
NON-RADIOLOGICAL ANALYTES OF POTENTIAL CONCERN
RISK ASSESSMENT

OPERABLE UNIT 1 RECORD
LORING AIR FORCE

	Range of SQLs		Frequency of Detection	Minimum Detected Concentration	MEG	CPC?	Notes
Area G: 1993 Groundwater* (mg/L)							
VOLATILE ORGANIC COMPOUNDS							
2-Hexanone							
					No	Toxicity Value6	
Chloroform			0.001 -	0.001			
0.1 -					No	Toxicity Screening2	
Ethylbenzene			0.001 -	0.001			
0.7 0.7					No	Toxicity Screening2	
Toluene			0.001 -	0.001			
1.4					No	Toxicity Screening2	
Total Xylenes			0.001 -	0.001			

10 0.6 No Toxicity Screening2
Trichloroethene 0.001 - 0.001
0.005 0.005 Yes Exceeds MCL and MEG8
cis-1,2-Dichloroethene 0.001 - 0.001
0.07 0.07 Yes Class1

SEMIVOLATILE ORGANIC COMPOUNDS
2-Methylnaphthalene 0.01 - 0.01
- No Toxicity Screening2
Acenaphthene 0.01 - 0.01
- No Toxicity Screening2
Fluorene 0.01 - 0.01
No Toxicity Screening2
Naphthalene 0.01 - 0.01
No Toxicity Screening2
Phenanthrene 0.01 - 0.01
- No Toxicity Screening2
bis(2-Ethylhexyl)phthalate 0.024 - 0.046
0.006 0.025 Yes

PESTICIDES/PCBs
Aldrin 0.00001 - 0.00001
NDB - - No Toxicity Screening2
Dieldrin 0.00002 - 0.00002
NDB - 0.00002 No Toxicity Screening2
Endosulfan II 0.00002 - 0.00002
NDB - - No Toxicity Screening2
Endrin Aldehyde 0.00002 - 0.00002
NDB - - No Toxicity Screening2
Heptachlor 0.00001 - 0.00001
NDB 0.0004 0.00008 No Toxicity Screening2
alpha-BHC 0.00001 - 0.00001
NDB - - No Toxicity Screening2
alpha-Chlordane 0.00001 - 0.00001
NDB 0.002 0.00027 No Toxicity Screening2
delta-BHC 0.00001 - 0.00001
NDB - - No Toxicity Value6
gamma-BHC (Lindane) 0.00001 - 0.00001
NDB 0.0002 0.0002 No Toxicity Screening2
gamma-Chlordane 0.00001 - 0.00001
NDB 0.002 0.00027 No Toxicity Screening2

INORGANIC ANALYTES
Aluminum
1.43 No Toxicity Value6
Arsenic 0.0052 - 0.0052
0.05 - Yes
Barium 0.145 - 0.145
1.5 Yes
Calcium
Essential Nutrient4
Chromium
0.1 Yes
Cobalt 0.0136 - 0.0136
- No Toxicity Screening2
Copper 0.0112 - 0.0112
1.3T - No Toxicity Screening2
Iron
Yes
Lead 0.002 - 0.002
0.015T 0.02 Yes State5

Magnesium
No Essential Nutrient4
Manganese
0.2 Yes
Nickel 0.0142 - 0.0142
0.15 No Toxicity Screening2
Potassium
No Essential Nutrient4
Sodium
Essential Nutrient4

MISCELLANEOUS PARAMETERS
Low Detection Limit Vinyl Chloride 0.0001 - 0.0001
NDB 0.002 0.00015 Yes Class1

Area G: 1992 Groundwater* (mg/L)

VOLATILE ORGANIC COMPOUNDS
1,2-Dichloroethene (total)
Yes
Acetone
Yes
Ethylbenzene
Yes
Total Xylenes
Yes
Trichloroethene
0.005 Yes

INORGANIC ANALYTES
Uranium (total U-234, U-235, U-238)
20 - Yes

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TABLE 6-1
NON-RADIOLOGICAL ANALYTES OF POTENTIAL CONCERN
RISK ASSESSMENT

OPERABLE UNIT 1 RECORD
LORING AIR FORCE

	Range of SQLs	Frequency of Detection	Minimum Detected Concentration	MEG	CPC?	Notes
Area A: Surface Water (mg/L)						
PESTICIDES/PCBs						
Heptachlor				-	Yes	

		INORGANIC ANALYTES					
		Calcium					
Background3, Essential Nutrient4							
		Copper					
Yes							
		Iron					
Background3							
		Magnesium					
Background3, Essential Nutrient4							
		Manganese					
No	Background3						
		Sodium					
Background3, Essential Nutrient4							
		Area A: Sediment (mg/kg)					
		SEMIVOLATILE ORGANIC COMPOUNDS					
		2-Methylphenol			0.4	-	0.46
No	Toxicity Screening2						
		Acenaphthene			0.4	-	0.51
Yes	Class1						
		Anthracene			0.4	-	0.51
Yes	Class1						
		Benzo(a)Anthracene			0.4	-	0.46
Yes							
		Benzo(a)Pyrene			0.4	-	0.51
Yes							
		Benzo(b,k)Fluoranthene					
Yes							
		Benzo(g,h,i)perylene			0.4	-	0.51
Yes	Class1						
		Carbazole			0.4	-	0.51
Toxicity Screening2							
		Chrysene			0.4	-	0.4
Class1							
		Dibenzofuran			0.4	-	0.51
No	Toxicity Screening2						
		Fluoranthene			0.4	-	0.4
Yes	Class1						
		Fluorene			0.4	-	0.51
Class1							
		Indeno(1,2,3-c,d)Pyrene			0.4	-	0.51
Yes							
		Phenanthrene			0.4	-	0.4
Yes	Class1						
		Pyrene					
Class1							
		PESTICIDES/PCBs					
		4,4'-DDE			0.0052	-	0.0052
-	No	Toxicity Screening2					
		4,4'-DDT					
No	Toxicity Screening2						
		Aldrin			0.0021	-	0.0033
-	No	Toxicity Screening2					
		Aroclor-1254			0.045	-	0.064
Yes							
		Aroclor-1260			0.052	-	0.052
Yes							
		Dieldrin			0.0045	-	0.0052
-	No	Toxicity Screening2					

Endosulfan Sulfate 0.004 - 0.004
- No Toxicity Screening2
Endrin 0.004 - 0.0064
- No Toxicity Screening2
Endrin Aldehyde 0.0052 - 0.0052
- - No Toxicity Screening2
Heptachlor Epoxide 0.002 - 0.0027
- - No Toxicity Screening2
Methoxychlor 0.021 - 0.027
- No Toxicity Screening2
alpha-Chlordane 0.0027 - 0.0033
- No Toxicity Screening2
delta-BHC 0.0021 - 0.0033
- No Toxicity Value6
gamma-Chlordane 0.0027 - 0.0033
- - No Toxicity Screening2

INORGANIC ANALYTES
Aluminum
No Background3
Arsenic
Background3
Barium
Toxicity Screening2
Beryllium 1.2 - 1.6
No Background3
Calcium
No Background3, Essential Nutrient4
Chromium
No Background3
Cobalt
Background3
Copper
Iron
Yes
Lead
State5
Magnesium
No Background3, Essential Nutrient4
Manganese
Yes
Mercury 0.12 - 0.16
No Toxicity Screening2
Nickel
Toxicity Screening2
Potassium 892 - 892
No Background3, Essential Nutrient4
Sodium
Essential Nutrient4
Uranium (total U-234, U-235, U-236)
- - No Toxicity Screening2
Vanadium
Zinc
Toxicity Screening2

NOTES:

Class1 - Although the toxicity screening ratio was less than 0.01, compounds where at least one compound within this class has a risk ration greate
Toxicity Screening2 - Chemicals with low rations (i.e. less than 0.

potential concern (CPCs)
Background3 - Sample concentrations detected are below background c
Essential Nutrient4 - Analyte is an essential human nutrient (magne
not considered a CPC.
State5 - The Maine Department of Environmental Protection (MEDEP, 1
concentrations less than 15 æ/L in groundwater and 125 mg/kg in soil are not eva
Toxicity Value6 - Compound cannot be evaluated quantitively because
Frequency7 - Frequency of detection is less than 5 percent.
Exceeds MCL/MEG8 - Maximum concentration is greater than MCL and/or

T - Action Level
* - If the mean exceeds the maximum concentration, only the maximum
quantitative evaluation.
** - Background for pesticides/PCBs provided for information only.
not screened against background concentrations.
- Secondary Standard
SQL - Sample Quantitation Limit
MCL - Maximum Contaminant Level; Drinking Water Regulations and Hea
Environmental Protection Agency Office of Water, May 1995.
MEG - Maximum Exposure Guideline; Maine Department of Human Service
mg - milligram
kg - kilogram
L - liter
æg - microgram NA - Background ground
overburden wells.
bgs - below ground surface NDB - Background not d
NC - mean not calculated
- - = No MCL or MEG available

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TABLE 6-2
SUMMARY OF RADIOLOGICAL ISOTOPES FOR HU
ASSESSMENT

OPERABLE UNIT 1 RECORD
LORING AIR FORCE

Radiological Analyte	Range of SQLs	Frequency of Detection	Minimum Detected Concentration	Notes
SURFACE SOIL (0-2 feet): Area Aa				
GAMMA SPECTROSCOPY -1-Hour Counts (pCi/g)				
Americium-241	0.138 -0.155	1 / 3	0.577	
Radium-228	700 -700	2 / 3	1.44	
SURFACE SOIL (0-2 feet): AREAS B-Gb				
GAMMA SPECTROSCOPY -1-Hour Counts (pCi/g)				
Radium-226	0.7 -1.41	3 / 9	1.86	

SUBSURFACE SOIL (0-10 feet): AREA Aa

GAMMA SPECTROSCOPY -1-Hour Counts (pCi/g)				
Americium-241	0.138	-0.155	1 / 3	0.577
Radium-226	700	-700	2 / 3	1.44

SUBSURFACE SOIL SAMPLES (0-10 feet): AREAS B-Gc

GAMMA SPECTROSCOPY -1-Hour Counts (pCi/g)				
Radium-226	0.066	-1.41	49 / 61	0.246
Radium-228	0.172	-0.192	42 / 46	0.666
ALPHA SPECTROSCOPY (pCi/g)				
Plutonium	0.013	-0.07	4 / 46	0.02
Protactinium-234			46 / 46	0.52
Thorium-227	0.015	-0.21	25 / 46	0.018
Thorium-228			46 / 46	0.838
Thorium-230	0.676	-0.941	31 / 46	0.61
Thorium-231	0.02	-0.1	30 / 46	0.01
Thorium-232			46 / 46	0.804
Thorium-234			46 / 46	0.52
Uranium-234			46 / 46	0.47
Uranium-235	0.02	-0.1	30 / 46	0.01
Uranium-238			46 / 46	0.52

COMPOSITE SAMPLES (0-14 feet): AREAS B-Gd

GAMMA SPECTROSCOPY -1-Hour Counts (pCi/g)				
Radium-226	0.901	-1.08	8 / 14	0.938

GROUNDWATER: AREA A, 1994*

GROSS BETA (pCi/L)			1 / 1	18

MCL3

TRITIUM (pCi/L)			1 / 1	538

MCL3

GROUNDWATER: AREA A, 1993*

GROSS ALPHA (pCi/L)			1 / 1	24

MCL4

GROSS BETA (pCi/L)			1 / 1	34

MCL3

ALPHA SPECTROSCOPY (pCi/L)				
Thorium-230			1 / 1	2.1
Uranium-234			1 / 1	2
Uranium-238			1 / 1	1.86

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TABLE 6-2
SUMMARY OF RADIOLOGICAL ISOTOPES FOR HU

OPERABLE UNIT 1 RECORD
LORING AIR FORCE

Radiological Analyte	Range of SQLs			Frequency of Detection	Minimum Detected Concentration	Notes
GROUNDWATER: AREAS B-G, 1994f						
GROSS ALPHA (pCi/L)	1	-	3.8	7 / 16	1	Exceeds MCL4
GROSS BETA (pCi/L)	3	-	3	12 / 16	3.7	MCL4
TRITIUM (pCi/L)	400	-	400	3 / 16	400	Below MCL3
EPA METHOD 9320 (pCi/L)						
Radium-226	0.5	-	0.5	3 / 4	0.69	Background2, Below MCL3
ALPHA SPECTROSCOPY (pCi/L)						
Protactinium-234				4 / 4	0.07	
Thorium-228	0.05	-	0.4	1 / 4	1.28	
Thorium-230	0.14	-	0.14	3 / 4	0.42	
Thorium-232	0.05	-	0.05	3 / 4	0.05	
Thorium-234				4 / 4	0.07	
Uranium-234				4 / 4	0.12	
Uranium-238				4 / 4	0.07	
GROUNDWATER: AREAS B-G, 1993f						
GROSS ALPHA (pCi/L)				16 / 16	1.2	MCL4
GROSS BETA (pCi/L)	3	-	12	9 / 16	9.3	MCL4
EPA METHOD 9320 (pCi/L)						
Radium-226	0.4	-	1.1	1 / 7	1.6	Below MCL3
ALPHA SPECTROSCOPY (pCi/L)						
Thorium-230				7 / 7	0.9	
Uranium-234	0.6	-	0.6	7 / 7	0.7	
Uranium-238	0.65	-	0.65	6 / 7	0.62	
GROUNDWATER: AREAS B-G, 1992g						
GROSS BETA	2	-	2	1 / 5	14.19	MCL3
ALPHA-SCAN		-				
Radium-226	0.5	-	0.5	2 / 5	1.32	
Uranium-234	1	-	1	4 / 5	3.8	
Uranium-235	1	-	1	4 / 5	1.15	
Uranium-238	1	-	1	1 / 5	3.04	

SURFACE WATER: AREA A AND OU 13h					
GROSS ALPHA (pCi/L)	1	-	2.6	1 / 5	2.8
MCL3					
GROSS BETA (pCi/L)	3	-	3	3 / 5	6.1
MCL3					
SEDIMENT: AREA Ai					
GAMMA SPECTROSCOPY -1-Hour Counts (pCi/g)					
Neptunium-237	0.45	-	0.5	1 / 3	0.509
Radium-226	0.7	-	1.28	1 / 3	2.43
Thorium-234	0.78	-	1.48	1 / 3	2.09
Uranium-235	0.289	-	0.316	1 / 3	0.0168

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TABLE 6-2
SUMMARY OF RADIOLOGICAL ISOTOPES FOR
ASSESSMENT

OPERABLE UNIT 1 RECORD
LORING AIR FORCE

Radiological Analyte	Range of SQLs			Frequency of Detection	Minimum Detected Concen-tration	Notes
SEDIMENT: OU 13j						
GAMMA SPECTROSCOPY -24-Hour Counts (pCi/g)						
Radium-226				4 / 4	0.972	
Thorium-234	0.37	-	0.486	1 / 4	0.92	
Uranium-235	0.0791	-	0.0966	2 / 4	0.112	
ALPHA SPECTROSCOPY (pCi/g)						
Neptunium-237	0.007	-	0.015	1 / 4	0.072	
Uranium-234	0.304	-	0.531	3 / 4	0.568	
Uranium-238	0.335	-	0.567	2 / 4	0.704	
SEDIMENT: WASTEWATER TREATMENT PLANTk						
ALPHA SPECTROSCOPY (pCi/g)						
Neptunium-237				1 / 1	0.033	

NOTES:
1 - For radiological analytes selected as CPCs, each detection abov
evaluated,
with the exception of gross beta results in groundwater for which t
2 - Detected concentration does not exceed associated background co

3 - Concentration of isotope or gross radiation does not exceed the
4 - Concentration of isotope or gross radiation exceeds the associa
5 - Highest 24-hour gamma spectroscopy result for Radium-226 in sed
calculation

Sample Locations:
a - Based on data from sample locations JSS-2081, -2082, JTB-2060
b - Based on data from sample locations JDT-2480, -2481, JSD-2560,
JTP-2401
c - Based on data from sample locations JDT-2480, -2481, JSD-2560,
-2660, JTP-2401, TRC01C through TRC23C, TRE01C through TRE23C
d - Based on data from sample locations MTB-2180, -2181, -2280, -22
-2482, -2580, -2680, -2681, -2682
e - Based on data from sample location JMW-2080
f - Based on data from sample locations JMW-2180, -2181, -2280, -22
-2482, -2580, -2680, -2681, -2682
g - Based on data from sample locations JMW-2180, -2280, -2380, -24
h - Based on data from sample locations JSW-0041, -0042, -0043, -00
i - Based on data from sample locations JDT-2080, 2081, JSD-2060
j - Based on data from sample locations JSD-0041, -0042, -0043, -00
k - Based on data from sample location JSD-0066

Acronyms:
SQL - Sample Quantitation Limit
MCL - Maximum Contaminant Level
MEG - Maximum Exposure Guideline
CPC - Chemical of Potential Concern
mg - milligram
kg - kilogram
L - liter
æg - microgram
bgs - below ground surface
ND - not detected
NA - no MCL/MEG available
- - MCL/MEG not relevent for this medium
NDB - not detected in background

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Potential human health risks associated with exposure to the CPCs w
quantitatively or qualitatively through the development of hypothet
pathways. These pathways were developed to reflect the potential f
hazardous substances based on present and potential future land use
exposure scenarios included older child trespasser and groundskeepe
exposure scenarios included resident, construction worker, older ch
groundskeeper, commercial/industrial worker, and forestry worker.

For each pathway evaluated, an average and a reasonable maximum exp
estimate was generated, corresponding to exposure to the average an
contaminant concentrations detected in that particular medium.

Excess lifetime cancer risks were determined for each exposure path

multiplying the exposure level with the chemical-specific cancer fa potency factors have been developed by USEPA from epidemiological a studies to reflect a conservative upper bound of the risk posed by carcinogenic compounds. That is, the true risk is unlikely to be g estimated risk. The resulting risk estimates are expressed in scie probability (e.g., 1x10-6 or one in a million) and indicate (using average individual is not likely to have greater that a one in a mi developing cancer over a lifetime of site-related exposure to the c stated concentration. Current USEPA practice considers carcinogeni additive when assessing exposure to a mixture of hazardous substanc

The hazard quotient (HQ) was also calculated for each pathway as a potential for noncarcinogenic health effects. An HQ is calculated exposure level by the reference dose (RfD) or other suitable benchm non-carcinogenic health effects for an individual compound. RFDs h developed by USEPA to protect sensitive individuals over the course and they reflect a daily exposure level that is likely to be withou of an adverse health effect. RfDs are derived from epidemiological and incorporate uncertainty factors to help ensure that adverse hea occur. The HQ is often expressed as a single value (e.g., 0.3) ind the stated exposure to the reference dose value (in this example, t characterized is approximately one third of an acceptable exposure compound). The HQ is only considered additive for compounds that h or similar toxic effect (e.g., the HQ for a compound known to produ should not be added to a second compound whose toxic effect is kidn The sum is referred to as the hazard index (HI).

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SECTION 6

The results of the human health risk assessment are summarized in S

6.2 ECOLOGICAL RISK ASSESSMENT

Following a methodology similar to the human health risk assessment risk assessment evaluates potential ecological effects resulting fr exposures to contaminants at OU 1. Ecological CPCs were selected f radiological and radiological analytes detected in surface soil, se water. The rationale for exclusion of selected compounds are inclu through 6-7.

Representative ecological receptor species were selected for the ha with OU 1. For Area A, five representative wildlife species were s quantitatively evaluate the magnitude of potential ecological expos occur. The receptors include:

short-tailed shrew (Blarina brevicauda); small mammal, om
American woodcock (Scolopax minor); small bird, omnivore
maritime garter snake (Thamnophis sirtalis pallidula); re
red fox (Vulpes vulpes); predatory mammal, carnivore
barred owl (Strix varia); predatory bird, carnivore

In addition, potential impacts to terrestrial plants and earthworms

potential exposure to other soil invertebrates, were also selected

Based on a habitat evaluation for Areas B through G, the following representative species were selected for the ecological exposure ev

meadow vole (Microtus pennsylvanicus); small mammal, herb
American robin (Turdus migratorius); small bird, omnivore
maritime garter snake; reptile, omnivore
red fox; predatory mammal, carnivore
American kestrel (Falco sparverius); predatory bird, carn

Five representative species were also selected to evaluate the risk potential exposure of wildlife to radiological contaminants in sedi

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TABLE 6-3
CHEMICALS OF POTENTIAL CONCERN FOR THE AREA A SURFACE SOIL RISK ASSESSMENT

OPERABLE UNIT 1 RECORD
LORING AIR FORCE

ANALYTE	CONCENTRATION AVERAGE (mg/kg) [b]	CONCENTRATION MAXIMUM (mg/kg)	FREQUENCY OF DETECTION	C
NOTES				
SEMIVOLATILES				
Acenaphthene	0.150 *	0.065	1 / 3	
Anthracene	0.150 *	0.065	1 / 3	
Benzo(a)Anthracene	0.129	0.160	2 / 3	
Benzo(a)Pyrene	0.161 *	0.099	1 / 3	
Benzo(b,k)Fluoranthene	0.329 *	0.218	1 / 3	
Carbazole	0.147 *	0.056	1 / 3	
Chrysene	0.124	0.150	2 / 3	
Fluoranthene	0.237	0.420	2 / 3	
Fluorene	0.145 *	0.050	1 / 3	
Indeno(1,2,3-c,d)Pyrene	0.145 *	0.049	1 / 3	
Phenanthrene	0.210	0.360	2 / 3	
Pyrene	0.178	0.280	2 / 3	
PESTICIDES/PCBs				
Aroclor-1260	0.0327	0.0610	1 / 3	
gamma-Chlordane	0.0010 *	0.0009	1 / 3	
4,4'-DDE	0.0009	0.0019	3 / 3	
4,4'-DDT	0.0019	0.0035	2 / 3	
Dieldrin	0.0016 *	0.0008	1 / 3	
Endosulfan Sulfate	0.0025	0.0031	2 / 3	
Endrin	0.0013 *	0.0002	1 / 3	
Endrin Aldehyde	0.0028	0.0046	1 / 3	
Endrin Ketone	0.0014 *	0.0005	1 / 3	
Methoxychlor	0.0045 *	0.0028	2 / 3	
INORGANICS				

Aluminum	13,933	16,100	3 / 3
Arsenic	5.37	6.20	3 / 3
Barium	30.4	36.6	3 / 3
Beryllium	0.40 *	0.23	1 / 3
Calcium	2,127	2,830	3 / 3
Chromium	27.9	33.1	3 / 3
Cobalt	9.97	11.6	3 / 3
Copper	18.3	22.1	3 / 3
Iron	26,167	30,200	3 / 3
Lead	16.2	23.4	3 / 3
Magnesium	6,460	7,490	3 / 3
Manganese	430	504	3 / 3
Nickel	35.4	44.1	3 / 3
Potassium	831	986	3 / 3
Sodium	57.3	85.4	3 / 3
Vanadium	18.6	21.0	3 / 3
Zinc	65.0	89.9	3 / 3

[a]Based on samples JSS-2081, JSS-2082 and JTB-2060
[b]Average concentration is the arithmetic mean of all sample resul
Some averages may exceed maximum
concentrations due to elevated SQLs.
[c]Base-wide surface soil background concentrations.
[d]Analyte has been detected in background samples; however, these
screen for CPCs.
Consideration of background levels of pesticides will be disc
[e]Maximum concentration of analyte is below maximum surface soil b
[f]Analyte is an essential nutrient, and is considered to be hazard
only at very high concentrations.
*Average concentration exceeds maximum due to elevated SQLs.
NA = not available
Shaded analytes are CPCs

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TABLE 6-4
CHEMICALS OF POTENTIAL CONCERN FOR THE AREAS B-F SUR
ECOLOGICAL RISK ASSESSMENT

OPERABLE UNIT 1 RECORD
LORING AIR FORCE

ANALYTE	CONCENTRATION AVERAGE (mg/kg) [b]	CONCENTRATION MAXIMUM (mg/kg)	FREQUENCY OF DETECTION	C NOTES
SEMIVOLATILES				
Benzo(b,k)Fluoranthene	0.341 *	0.082	1 / 4	
bis(2-Ethylhexyl)phthalate	0.145 *	0.044	2 / 5	
Chrysene	0.172 *	0.054	1 / 5	
Fluoranthene	0.178 *	0.077	1 / 5	
Phenanthrene	0.188 *	0.048	1 / 5	
Pyrene	0.174 *	0.057	1 / 5	

PESTICIDES/PCBs			
Aroclor-1260	0.0191 *	0.0090	1 / 5
delta-BHC	0.0009 *	0.0002	1 / 5
4,4'-DDD	0.0012 *	0.0010	3 / 5
4,4'-DDE	0.0024	0.0045	5 / 5
4,4'-DDT	0.0044	0.0095	4 / 5
Dieldrin	0.0016 *	0.0006	2 / 5
Endosulfan Sulfate	0.0019 *	0.0005	1 / 5
Endrin	0.0018 *	0.0007	1 / 5
Endrin Aldehyde	0.0017 *	0.0005	1 / 5
Heptachlor Epoxide	0.0009 *	0.0002	1 / 5
INORGANICS			
Aluminum	16,020	17,800	5 / 5
Arsenic	7.21	10.1	5 / 5
Barium	44.4	59.9	5 / 5
Beryllium	0.52	0.54	3 / 5
Calcium	4,394	17,800	5 / 5
Chromium	31.4	33.9	5 / 5
Cobalt	12.6	16.1	5 / 5
Copper	20.3	27.2	5 / 5
Iron	29,430	32,300	5 / 5
Lead	21.7	32.1	5 / 5
Magnesium	7,680	8,950	5 / 5
Manganese	735	998	5 / 5
Mercury	0.57	2.60	1 / 5
Nickel	40.7	46.5	5 / 5
Potassium	823	1,110	5 / 5
Silver	0.767	1.20	1 / 5
Sodium	100	124	5 / 5
Vanadium	22.0	24.8	5 / 5
Zinc	85.5	141	5 / 5

[a]Based on samples JDT-2480, JDT-2481, JSD-2560, JTB-2260, JTP-204
[b]Average concentration is the arithmetic mean of all sample resul
Some averages may exceed maximum
concentrations due to elevated SQLs.
[c]Base-wide surface soil background concentrations.
[d]Analyte has been detected in background samples; however, these
screen for CPCs.
Consideration of background levels of pesticides will be discus
[e]Maximum concentration of analyte is below maximum surface soil b
[f]Analyte is an essential nutrient, and is considered to be hazard
only at very high concentrations.
*Average concentration exceeds maximum due to elevated SQLs.
NA = not available
Shaded analytes are CPCs.

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TABLE 6-5
CHEMICALS OF POTENTIAL CONCERN FOR THE AREA G SURF
ECOLOGICAL RISK ASSESSMENT

OPERABLE UNIT 1 RECORD
LORING AIR FORCE

ANALYTE	CONCENTRATION AVERAGE (mg/kg) [b]	CONCENTRATION MAXIMUM (mg/kg)	FREQUENCY OF DETECTION	C
NOTES				
SEMIVOLATILES				
2-Methylnaphthalene	6.16	36.0	1 / 6	
Anthracene	4.33	25.0	1 / 6	
Benzo(a)Anthracene	0.935 *	0.110	1 / 6	
Benzo(a)Pyrene	0.923 *	0.038	1 / 6	
Benzo(b,k)Fluoranthene	1.86 *	0.145	1 / 6	
bis(2-Chloroisopropyl)ether	0.924 *	0.076	1 / 6	
Butylbenzylphthalate	0.912 *	0.140	2 / 6	
Chrysene	0.937 *	0.120	1 / 6	
Di-n-butylphthalate	0.923 *	0.043	1 / 6	
Fluoranthene	0.631	3.10	3 / 6	
Naphthalene	1.83	10.0	1 / 6	
Phenanthrene	2.16	12.0	1 / 6	
Pyrene	1.49	8.200	3 / 6	
PESTICIDES/PCBs				
Aldrin	0.0013	0.0036	2 / 6	
Aroclor-1260	0.0480	0.1000	3 / 5	
beta-BHC	0.0048	0.0240	1 / 6	
delta-BHC	0.0026	0.0110	2 / 6	
gamma-BHC (Lindane)	0.0048	0.0240	1 / 6	
alpha-Chlordane	0.0032	0.0130	3 / 6	
gamma-Chlordane	0.0035	0.0100	4 / 6	
4,4'-DDD	0.0038	0.0110	1 / 5	
4,4'-DDE	0.0042	0.0140	2 / 5	
4,4'-DDT	0.0127	0.0420	4 / 6	
Dieldrin	0.0010 *	0.0004	3 / 5	
Endosulfan I	0.0009	0.0013	3 / 6	
Endosulfan II	0.0214	0.1200	2 / 6	
Endosulfan Sulfate	0.0055	0.0240	3 / 6	
Endrin	0.0018	0.0027	2 / 6	
Endrin Aldehyde	0.0018 *	0.0013	1 / 5	
Endrin Ketone	0.0025	0.0052	1 / 6	
Heptachlor	0.0008	0.0001	1 / 5	
Heptachlor Epoxide	0.0026	0.0110	3 / 6	
Methoxychlor	0.0062 *	0.0005	2 / 5	
INORGANICS				
Aluminum	18,075	22,000	6 / 6	
Arsenic	5.87	8.60	6 / 6	
Barium	61.8	157	6 / 6	
Beryllium	0.54 *	0.30	1 / 6	
Cadmium	2.46	11.8	1 / 6	
Calcium	6,775	23,500	6 / 6	
Chromium	39.7	81.4	6 / 6	
Cobalt	11.9	19.3	6 / 6	
Copper	149	790	6 / 6	
Iron	28,633	34,400	6 / 6	
Lead	97.7	493	4 / 6	
Magnesium	7,953	13,500	6 / 6	
Manganese	597	999	6 / 6	
Mercury	0.42	2.20	2 / 6	

Nickel	40.1	69.5	6 / 6
Potassium	1,053	2,170	6 / 6
Sodium	74.0	139	4 / 6
Vanadium	31.6	68.3	6 / 6
Zinc	271	1,240	6 / 6

[a]Based on samples JSS-2680, JSS-2681, JSS-2682, JTB-2660, JTB-268
[b]Average concentration is the arithmetic mean of all sample resul
Some averages may exceed maximum
concentrations due to elevated SQLs.
[c]Base-wide surface soil background concentrations.
[d]Analyte has been detected in background samples; however, these
screen for CPCs.
Consideration of background levels of pesticides will be discus
[e]Maximum concentration of analyte is below maximum surface soil b
[f]Analyte is an essential nutrient, and is considered to be hazard
only at very high concentrations.
*Average concentration exceeds maximum due to elevated SQLs.
NA = not available
Shaded analytes are CPCs.

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TABLE 6-6
CHEMICALS OF CONCERN FOR THE AREA A (DRAINAGE DITCH) S
ECOLOGICAL RISK ASSESSMENT

OPERABLE UNIT 1 RECORD
LORING AIR FORCE

ANALYTE	DETECTED CONCENTRATION (æg/L)	FREQUENCY OF DETECTION	MAXIMUM BACKGROUND CONCENTRATION (æg	NOTES
PESTICIDES/PCBs				
Heptachlor	0.0011	1 / 1		N
INORGANICS				
Calcium	52,600	1 / 1	67,20	
Copper	12.3	1 / 1	2.	
Iron	486	1 / 1	96	
Magnesium	2,850	1 / 1	8,28	
Manganese	45.3	1 / 1	62.	
Sodium	4,300	1 / 1	6,52	

NOTES:
[a]Based on samples JSW-2080.
[b]Base-wide surface water background concentrations.
[c]Analyte has been detected in background samples; however, these
for CPCs.
Consideration of background levels of pesticides is discussed
[d]Maximum concentration of analyte below screening benchmark.
[e]Maximum concentration of analyte below maximum surface water bac

[f]Analyte is an essential nutrient and is not known to adversely i
concentrations.
NA = Not available.
Shaded analytes are CPCs.

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TABLE 6-7
CHEMICALS OF CONCERN FOR THE AREA A (DRAINAGE DITCH)
ECOLOGICAL RISK ASSESSMENT

OPERABLE UNIT 1 RECORD
LORING AIR FORCE

ANALYTE	CONCENTRATION AVERAGE (mg/kg) [b]	CONCENTRATION MAXIMUM (mg/kg)	FREQUENCY OF DETECTION	C	NOTES
SEMIVOLATILES					
2-Methylphenol	0.147 *	0.130	2 / 3		
Acenaphthene	0.210 *	0.160	1 / 3		
Anthracene	0.227 *	0.210	1 / 3		
Benzo(a)Anthracene	0.252	0.470	2 / 3		
Benzo(a)Pyrene	0.277	0.360	1 / 3		
Benzo(b,k)Fluoranthene	0.308	0.670	3 / 3		
Benzo(g,h,i)perylene	0.200 *	0.130	1 / 3		
Carbazole	0.223 *	0.200	1 / 3		
Chrysene	0.225	0.460	3 / 3		
Dibenzofuran	0.181 *	0.072	1 / 3		
Fluoranthene	0.549	1.300	3 / 3		
Fluorene	0.193 *	0.110	1 / 3		
Indeno(1,2,3-c,d)Pyrene	0.227 *	0.210	1 / 3		
Phenanthrene	0.401	0.940	3 / 3		
Pyrene	0.315	0.720	3 / 3		
PESTICIDES/PCBs					
Aldrin	0.0020	0.0051	1 / 3		
Aroclor-1254	0.0598	0.2200	1 / 3		
Aroclor-1260	0.2387	0.7400	2 / 3		
delta-BHC	0.0012 *	0.0004	1 / 3		
alpha-Chlordane	0.0038	0.0150	1 / 3		
gamma-Chlordane	0.0019	0.0040	1 / 3		
4,4'-DDE	0.0033	0.0120	2 / 3		
4,4'-DDT	0.0013	0.0018	3 / 3		
Dieldrin	0.0033	0.0059	2 / 3		
Endosulfan Sulfate	0.0033	0.0046	3 / 3		
Endrin	0.0019	0.0025	2 / 3		
Endrin Aldehyde	0.0065	0.0140	2 / 3		
Heptachlor Epoxide	0.0009 *	0.0004	1 / 3		
Methoxychlor	0.0088 *	0.0020	1 / 3		
INORGANICS					
Aluminum	16,950	18,800	3 / 3		
Arsenic	9.17	10.4	3 / 3		

Barium	96.2	150	3 / 3
Beryllium	0.62 *	0.48	1 / 3
Calcium	4,678	7,060	3 / 3
Chromium	38.6	48.4	3 / 3
Cobalt	16.2	22.3	3 / 3
Copper	372	1,200	3 / 3
Iron	38,883	56,500	3 / 3
Lead	84.5	256	3 / 3
Magnesium	8,580	10,000	3 / 3
Manganese	2,555	5,070	3 / 3
Mercury	0.24	0.67	2 / 3
Nickel	49.6	63.6	3 / 3
Potassium	858	1,140	2 / 3
Sodium	103	138	3 / 3
Uranium	0.057 *	0.051	1 / 3
Vanadium	33.4	54.6	3 / 3
Zinc	286	655	3 / 3
Total Organic Carbon	3,400	3,400	1 / 1

TABLE 6-7
CHEMICALS OF CONCERN FOR THE AREA A (DRAINAGE DITCH)
ECOLOGICAL RISK ASSESSMENT

OPERABLE UNIT 1 RECORD
LORING AIR FORCE

NOTES:
[a]Based on samples JDT-2080, JDT-2081 and JSD-2060
[b]Average concentration is the arithmetic mean of all sample resul
Some averages may exceed maximum
concentrations due to elevated SQLs.
[c]Base-wide sediment background concentrations.
[d]Maximum concentration of analyte below screening benchmark.
[e]Analyte has been detected in background samples; however, these
for CPCs.
Consideration of background levels of pesticides is discussed
[f]Maximum concentration of analyte below maximum sediment backgrou
[g]Analyte is an essential nutrient, and is not known to adversely
concentrations.
[h]Analyte is a CPC for aquatic exposures only.
*Average concentration exceeds maximum due to elevated SQLs.
NA = Not available.
Shaded analytes are CPCs.

muskrat (Ondatra zibethicus); small mammal, herbivore
belted kingfisher (Ceryle alcyon); medium-sized bird, p
maritime garter snake; reptile, omnivore
great blue heron (Ardea herodias); large bird, omnivore
mink (Mustela vison); predatory mammal, omnivore

With the CPCs and receptors selected, the evaluation of exposure pa of CPCs, and resulting risks followed an approach similar to that o risk assessment.

Results of the ecological risk assessment are summarized in Subsect

6.3 UNCERTAINTY EVALUATION

Quantitative estimates of risk are based on numerous assumptions, w intended to be protective of human health and the environment (i.e. The interpretation of risk estimates is subject to a number of unce of the multiple layers of conservative assumptions inherent in risk such, risk estimates are not truly probabilistic estimates of risk, estimates, given a series of conservative assumptions about exposur While it is true that there are some uncertainties inherent in the methodology that might lead to an underestimation of true risks, mo bias the evaluation in the direction of overestimation of risk. Th conservative clean-up criteria, more protective of human health and

The possibility of underestimation of true risks may be caused by t exposure pathways from quantitative evaluation (i.e., ingestion of produce from backyard garden plots) or through the exclusion of com the risk assessment through the CPC selection procedure. However, selection procedure evaluated compounds that constituted more than the risk; therefore it is unlikely that the risks will be underesti amount.

Other sources of uncertainty that could cause overestimation of ris of purposive sampling (biased targeting of "hot spots" or visible c estimation of exposure concentrations by the use of maximum detecti assuming no degradation or dilution); the use of the 95 percent (or percent) exposure parameter values such as contact rate and exposur

duration; the use of conservatively derived toxicity values such as multiple safety factors); and cancer slope factors, which are based animal data used in a multi-stage model.

6.4 RISK ASSESSMENT CONCLUSIONS

Summaries of both human health and ecological risk assessments are the following paragraphs. The discussion begins with the radiologi waste disposal trenches and ends with conclusions for Area A and Ar

G.

Radiological USTs. Based on the UST data, analysis of confirmatory and downgradient groundwater quality, the USTs were not sources of non-radiological contamination.

Waste Disposal Trenches. No human health radiological risks above target risk levels were associated with the Trench C and E confirma following the removal action.

Arsenic was detected above background concentrations in only one ou confirmatory soil samples at Trench E. Based on this result, subsu radiological human health carcinogenic and non-carcinogenic risks w predominantly attributable to arsenic in combined Areas B through G arsenic is not a documented contaminant associated with OU 1 strate maintenance, nor was there widespread detection of this analyte. T detection of arsenic may be the result of rodenticide application a Trench E location.

Area A Soils, Surface Water, and Sediments. No human health non-ra have been identified at Area A in soils, surface water, or sediment regulatory target risk levels. No ecological radiological risks ha Area A soils and sediments.

Total maximum cancer risks associated with exposure to radionuclide soil above established background concentrations range from 5x10-4 Maximum radiological risks identified for sediment (1x10-5) are les established background risks for that medium (2x10-5). These risks minimal incremental cancer risk above the LAFB background risks of

and are less than published total natural radiological background r States of 1x10-2 to 3x10-3 (Shleien, 1992).

A portion of the radiological human health risks is attributable to with a single surface soil sample adjacent to the former Area A rad As discussed in Section 5.0, this data is suspect due to analytical identifying and quantifying these radionuclides. To be conservativ was included in the risk assessments. It constitutes only a minima to total natural background levels for the United States (1x10-2 to

Elevated human health risks from Ra-226 (maximum cancer risk of 2x1 associated with surface soils and one ditch sediment. Ra-226 is ab 1994 background levels at these locations. Ra-226 is ubiquitous at considered to be part of natural background. At LAFB background le occurring Ra-226 alone contributes a maximum cancer risk of 2x10-4. reduction of risk attributable to radioactive isotopes is not possi levels of naturally occurring radioactive isotopes.

Analytical data for the surface water collected from the Area A dra evaluated, and only copper was detected at concentrations in excess benchmarks. A review of the toxicological data for copper suggests

that would likely use this ephemeral habitat (such as amphibians) w impacted at the concentration reported. The data and rationale for are presented in the OU 1 RI Report (ABB-ES, 1995a). No impacts to growing in Area A surface soil or to other terrestrial receptors we ecological risk assessment.

Area A Groundwater. No human health radiological risks above regul risk levels have been identified associated with potential resident exposures at Area A.

Background concentrations of inorganics in overburden and bedrock g currently being revised as part of the OU 12 basewide groundwater R Concentrations of inorganics in groundwater detected at OU 1 will b the OU 12 background concentrations upon approval and acceptance of Groundwater inorganic data for OU 1 will be addressed in the OU 12

Areas B through G Soils. Total maximum cancer risks associated wit detected radionuclides in soil at levels above established backgrou

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range from 5x10-4 to 2x10-5. These risks represent a minimal incre above the LAFB soil background risks of 2x10-4 to 6x10-6, and are w published total natural radiological background risks of 1x10-2 to 1992).

The maximum radiological human health risk of 5x10-4 is based on Ra in surface, subsurface, and composite soil samples. As discussed i Ra-226 is naturally occurring at OU 1. At LAFB off-site background risk of 2x10-4 is associated with naturally occurring Ra-226. The health risks at Areas B through G are considered acceptable because result of naturally occurring Ra-226.

No non-radiological human health carcinogenic or non-carcinogenic r regulatory target risk levels were identified in surface soils at A except for a single surface soil sample at Area G (JSS-2680). The analysis indicated a non-carcinogenic risk due to inhalation of bar forestry worker and construction worker scenarios. JSS-2680 was th sample location out of 17 collected at OU 1 in which barium was det background levels.

No ecological radiological risks were indicated at Areas B through non-radiological risks at Areas B through F were indicated due to a mercury result in one Area C surface soil sample. The mercury conc suggested risk to the red fox, and exceeded the screening benchmark plants. Mercury was detected only once out of six surface soil sam through F. Zinc exceeded screening benchmarks to terrestrial inver plants due to one surface soil result at Area G.

Ecological non-radiological risk at Area G was calculated for zinc surface soil for lethal effects to the robin and red fox, respectiv of 2-methylnaphthalene, chromium, copper, and zinc also exceeded th toxicological benchmarks for terrestrial invertebrates. Concentrat

chromium, copper, lead, mercury, vanadium, and zinc exceeded the sc benchmarks for terrestrial plants. Maximum concentrations of all r ecological CPCs were detected at sample location JSS-2680, which is head of the drainage ditch at Area G. Potential ecological impacts spatially limited, and it is unlikely that mobile wildlife would be

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Area B through G Groundwater. A total maximum radiological risk of identified for potential residential exposure to overburden groundw does not exceed USEPA's target risk range or MEDEP's cancer risk gu The site-specific risk level represents a minimal incremental cance LAFB groundwater background risk level of 9x10-7 and is below publi natural radiological background risks of 1x10-2 to 3x10-3 (Shleien,

Total maximum radiological risks of 4x10-5 to 4x10-6 were identifie residential exposure to bedrock groundwater. Groundwater samples f out of the four at Area G indicated radiological risk due to Ra-226 Ra-226 concentration is only slightly above the LAFB background con represents a minimal incremental cancer risk as compared to publish backgrounds risks.

Non-radiological Area G bedrock groundwater data were separated fro through F during risk assessment because fuel oil USTs at Area G ha groundwater quality. Area G non-carcinogenic risks range from HIs Those above the target HI of 1 were attributable to arsenic, iron, Bis(2-ethylhexyl)phthalate (BEHP) and arsenic were identified as th risk drivers from Area G groundwater with a maximum risk of 3x10-4 BEHP is a common laboratory contaminant, and not likely to be site-

Evaluation of Radionuclides and Inorganics Detected at OU 1. Two s have been developed to present conclusions with respect to radionuc inorganics, Tables 6-8 and 6-9, respectively. These tables summari radionuclides and inorganics detected above background, the site ar were detected, and present discussion and conclusions. The purpose is to put into perspective the detections above background within O

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T
EVALUATION OF RADIONUC

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MEDIUM	ANALYTICAL	CPC	CONCLUSIONS

	METHOD		D
Subsurface Soil	ALPHA-SPEC	Thorium-228	C

radioisotope responsible for elevated radiological risks at OU 1. Radium-226 wa

in soils at all areas of OU 1. Radium-226 is one of

	ALPHA-SPEC	Thorium-230	C

radionuclides on the OU 1 isotope list. Radium-226 was added to the

associated with aircraft instrumentation dials might have

	ALPHA-SPEC	Thorium-231	C

No dials were reported during the trench removals. The background value

background soil samples were also collected and analyzed

	ALPHA-SPEC	Thorium-232	A

background values. The 1993 background samples indicated levels of Radium-226

maximum detected site-related Radium-226 result.

	ALPHA-SPEC	Uranium-235	C

Radium-226 at OU 1 is indicative of natural occurrence.

sample. This result is highly questionable as to

	GAMMA-SPEC	Radium-226	B

due to analytical interference (Note: The laboratory reported bad peak shape).

soil results do not indicate a source of base-related

	GAMMA-SPEC	Radium-228	A

human health radiological risks above regulatory risk levels were identified for

Target isotopes detected in soil are all naturally

Surface Soil	GAMMA-SPEC	Americium-241	A

Americium-241 which is mentioned above.

	GAMMA-SPEC	Radium-226	A
Surface water		NONE	

above regulatory thresholds indicated by radiological surface

the sediments are all naturally occurring with the

Sediment	ALPHA-SPEC	Neptunium-237	O

Neptunium-237 results obtained by gamma-spectroscopy have a large degree of

Neptunium-237 was detected in sediment background samples by

	GAMMA-SPEC	Neptunium-237	A

alpha-spectroscopy. A positive detection of Neptunium-237 by alpha

Based on this information, Neptunium-237 is

	GAMMA-SPEC	Radium-226	A

caused by the analytical procedures.

	GAMMA-SPEC	Thorium-234	A
	ALPHA-SPEC	Uranium-234	O
	GAMMA-SPEC	Uranium-235	
	ALPHA-SPEC	Uranium-238	O
Groundwater	GROSS-ALPHA	Gross Alpha	C

results did not indicate risks of concern at OU 1, except for Radium-226 in one

to be attributable to turbidity in the groundwater

GROSS-BETA	Gross Beta	B

however these parameter are greatly influenced by

ALPHA-SCAN/SPEC	Radium-226	G

background data collected for both dissolved and total radioisotopes. Gross

assessment; however, when either of these

ALPHA-SPEC	Thorium-228	E

water standards (MCLs), further isotope-specific analysis was

to determine what impact, if any, base-related

ALPHA-SPEC	Thorium-230	A

groundwater quality. A risk assessment was performed using the target

ALPHA-SPEC	Thorium-232	C

data do not indicate a base-related source of contamination. All isotopes

TRITIUM	Tritium	A
ALPHA-SPEC/SCAN	Uranium-234	A
ALPHA-SCAN/SPEC	Uranium-235	B
ALPHA-SPEC/SCAN	Uranium-238	B

NOTES:
MCL = Maximum Contaminant Level
LLRWD = Low Level Radioactive Waste Disposal Sites
ALPHA-SPEC = Alpha Spectroscopy
GAMMA-SPEC = Gamma Spectroscopy
CPC = Compound of Potential Concern
pCi/g = Picocuries per gram
>BKG = Greater than established background values.

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T
EVALUATION OF INORGANICS D
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OPERABLE UNIT
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MEDIUM	ANALYTICAL METHOD	CPC	CONCLUSIONS D
Subsurface Soil	CLP TAL-INOR	Arsenic	

contributing to the elevated risks at OU 1 are primarily arsenic, barium, mercur

background value in only 2 out of 75 soil samples. The

Lead

			closely gridded (equally spaced) Trench E confirmatory soil
			background concentration in only 1 out of 75 samples.
		CLP TAL-INOR	Barium
			located at the head of the drainage ditch at Area G. Mercury was
			of 75 soil samples. The maximum mercury result is
			Cadmium
			Area G. A second Area G drainage ditch sample collected
			contain barium or mercury greater that background. Zinc
			Chromium
			concentration in 9 out of 75 soil samples. These sporadic
			areas.
			Cobalt
			Copper
			Lead
			Mercury
			Silver
			Vanadium
			Zinc
	Surface Water (Area A only)	CLP TAL-INOR	Copper
			contributing to elevated ecological risks for surface water and sediment at Area
			three sediment samples were collected in the drainage ditch
	Sediment (Area A only)	CLP TAL-INOR	Barium
			surface water and sediment produced elevated ecological risks. Zinc in the
			ecological risk. A review of the toxicological data for copper
			Copper
			habitat would not be impacted. Zinc concentrations
			plant receptors. However, the screening benchmarks used
			Iron
			primarily below established LAFB background concentrations, and
			ERA suggest that impacts to wildlife are unlikely.
			Lead
			attributable to overland runoff and accumulation.
			Manganese
			Mercury
			Nickel
			Vanadium
			Zinc
	Groundwater	CLP TAL-INOR	Arsenic
			contributing to elevated risks for groundwater at OU 1 were arsenic, iron, manga

was likely detected at greater than background values due
Barium
inorganic analytes are naturally occurring in the soil and can cause elevated
in samples. This is supported by the background
Beryllium
under OU 12. Iron and manganese are responsible for up to 90%
iron or manganese have promulgated drinking water
Chromium
of the carcinogenic risks from groundwater. Arsenic is
Iron
State of Maine and is a commonly detected groundwater element.
were all well below the MCL of 50æg/L.
Lead
samples out of 40 collected. All the detections were below or at the
below the MCL of 4.0 æg/L.
Manganese
inorganics do not indicate any base-related inorganic source areas at OU 1.
Nickel
Vanadium

NOTES:
CPC = Compound of Potential Concern
>BKG = Greater than established background values.
* = Background values are for bedrock groundwater only. Overburden
been established to date for LAFB.
Some of the maximum concentrations listed may be from overburde
proper comparison to background is not possible.
CLP TAL-INOR = Contract Lab Program Target Analyte List of Inorgani
MCL = Maximum Contaminant Level
CRDL = Contract Required Detection Limit
ERA = Ecological Risk Assessment
LAFB = Loring Air Force Base
æg/L = Micrograms per liter

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7.0 DESCRIPTION OF THE NO ACTION ALTERNATIVE

Sampling conducted after the removal actions were completed at the
confirmed that no significant radiological or non-radiological cont

background concentrations remained at the former UST or disposal tr
Analysis of groundwater sampled from monitoring wells installed dow
USTs and disposal trenches did not consistently detect contaminatio
or MEGs, other than that attributable to background variation or sa

In accordance with USEPA guidance, additional monitoring and five-y
not necessary for sites where no hazardous substances, pollutants,
remain at levels that would necessitate restricted use or access (U
Because the USTs and waste disposal trenches were removed during th
action and results of the RI indicate no substantial contamination
additional monitoring and five-year reviews will not be conducted.

Based on these results, and the baseline risk assessment, no furthe
under CERCLA is considered necessary for OU 1 at LAFB. Areas A thr
OU 1 will be removed from the IRP. Area G will also be removed fro
and be redesignated as a non-CERCLA site that will be managed in ac
the Maine UST regulations.

Remediation of the contaminated soil and groundwater associated wit
fuel oil UST and abandoned pipeline is best addressed as a non-CERC
conducted under Maine UST regulations. The authority of CERCLA is
the hazardous substances defined in Section 101(14) of the law. Un
101 and 104 of CERCLA, petroleum products are excluded from regulat
CERCLA. Remediation of the contaminated soil and groundwater assoc
the former fuel oil UST and abandoned pipeline will be addressed as
CERCLA action conducted under the Maine UST regulations.

Section 12 of the Maine UST regulations (06-096 CMR 691) outlines r
for leak investigation, response, and corrective action. Many of t
response and investigation have been met during the course of repla
216 USTs and conducting the RI. Further response at Area G, in acc
Section 12 requirements, potentially includes soil remediation, gro
treatment, and monitoring.

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SECTION 7

If during the course of the UST remedial response, CERCLA-regulated
identified at concentrations that pose risk to human health or the
Area G of OU 1 will be managed under the IRP and CERCLA.

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8.0 DOCUMENTATION OF NO SIGNIFICANT CHANGES

The USAF prepared a Proposed Plan for OU 1 (ABB-ES, 1995b). The Pr Plan describes the USAF's recommendation to pursue no further actio CERCLA at OU 1. There have been no significant changes made to the under CERCLA decision stated in the Proposed Plan.

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9.0 STATE ROLE

MEDEP, on behalf of the State of Maine, reviewed the RI Report and Plan and indicated its support for the selected remedy. MEDEP con selected remedy for OU 1. A copy of the declaration of concurrenc Appendix C.

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GLOSSARY OF ACRONYMS AND ABBREVIATION

ABB-ES	ABB Environmental Services, Inc.
Am	Americium
BEHP	bis(2-ethylhexyl)phthalate
CERCLA	Comprehensive Environmental Restoration, Compensation, an Liability Act
CPC	contaminants of potential concern
CRP	Community Relations Plan
DOD	Department of Defense
FFA	Federal Facilities Agreement
HI	hazard index
HQ	hazard quotient
IRP	Installation Restoration Program

LAFB	Loring Air Force Base
LLRWDS	Low Level Radioactive Waste Disposal Sites
MCL	Maximum Contaminant Levels
MEDEP	Maine Department of Environmental Protection
MEG	Maximum Exposure Guidelines
NCP	National Contingency Plan
Np	Neptunium
NPL	National Priorities List
OU	operable unit
Ogden	Ogden Environmental and Energy Services, Inc.
Pa	Protactinium
PA	Preliminary Assessment
PAH	polyaromatic hydrocarbons
PCB	polychlorinated biphenyls
Ra	Radium

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GLOSSARY OF ACRONYMS AND ABBREVIATIONS

RAB	Restoration Advisory Board
RfD	reference dose
RI	Remedial Investigation
RME	reasonable maximum exposure
ROD	Record of Decision
SI	Site Inspection
SVOC	semivolatile organic compounds
Th	Thorium
TCE	trichloroethene
U	Uranium
USAF	U.S. Air Force
USEPA	U.S. Environmental Protection Agency
UST	underground storage tank
VOC	volatile organic compounds
WSA	weapons storage area

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W0049530.080

APPENDIX A

TRANSCRIPT OF THE PUBLIC MEETING (AUGUST 2, 1995)

W0049530.080

STATE OF MAINE AROOSTOOK,

LORING AIR FORCE BASE
OPERABLE UNIT 1

CARY MEDICAL CENTER
VAN BUREN ROAD
CARIBOU, MAINE
8:03 P.M.

Philip R. Bennett, Jr.,
Court Reporter
13 Vaughn Street
Caribou, Maine 04736
(207)498-2729

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EXHIBITS

LORING AIR FORCE BASE, OPERABLE UNIT #1

August 2, 1995

PETER FORBES: Good evening. Welcome to the public hearing to receive comments on the proposed plan for Operable Unit 1 at Loring Air Force Base, the Low Level Radioactive Waste Disposal Sites.

Today's date is August 2nd, 1995. My name is Peter Forbes, the Remedial Project Manager for the Installation Restoration Program at Loring. And seated with me are Michael Nalipinski of the U.S. Environmental Protection Agency and Naji Akladiss of the Maine Department of Environmental Protection. They will assist me in receiving your comments tonight.

This hearing is being held in accordance with the

provisions of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended in 1986 also known as Superfund. The act requires federal facilitie on the National Priorities List to present clean up proposal to the local community for comment and consideration before the final clean up decisions are made. The purpose of this hearing is to receive comments on the Proposed Plan for Operable Unite 1.

Mr. Phil Bennett from Aroostook Legal Reporters will

serve as the court reporter tonight, preparing a verbatim record of the proceedings. The verbatim record will become part of the final clean up plan. The court reporter will be able to make a complete record only if he is able to hear an understand what you say. With that in mind, please follow a few ground rules. Speak only after I recognize you and please address your remarks to me. State your name and the organization you represent and present your statement. Please do not state your address or any other personal information which you do not want to become a matter of the public record. Do not begin speaking until you have reached the podium. Speak slowly and clearly into the microphone. If you have prepared a statement beforehand, you may read it aloud or you may describe it and place it on this table.

Now are there any individuals who would like to make a comment or question or statement at this time?

Okay. Well, ladies and gentlemen, it's 8:05 p.m., August 2nd, 1995. I declare the public hearing to receive

comments on the Proposed Plan for Operable Unit 1 at Loring Air Force Base closed. Thank you for coming.

END OF HEARING

CERTIFICATION

I HEREBY CERTIFY THAT the foregoing is a true and correct transcript of the record of proceedings held on the aforementioned date.

Philip R. Bennett, Jr.,
Court Reporter

STATE OF MAINE AROOSTOOK, ss.

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RESPONSIVENESS SUMMARY

W0049530.080

FINAL

Loring Air Force Base

OU 1 RESPONSIVENESS SUMMARY

AUGUST 1995

Prepared for:

Air Force Base Conversion Agency
Limestone, Maine
(207) 328-7109

Prepared by:

Service Center: Hazardous Waste Remedial Actions P
Oak Ridge, Tennessee

Contractor: ABB Environmental Services, In
Portland, Maine

Project No. 7656-16

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The U.S. Air Force (USAF) held a 30-day comment period from July 1 August 16, 1995, to provide an opportunity for the public to commen Proposed Plan and other documents developed for Operable Unit No. 1 Loring Air Force Base, Maine. The Proposed Plan is the document th remedial action objectives, evaluates remedial alternatives, and re alternative that best meets the evaluation criteria for OU 1. The preliminary recommendations of its preferred alternative for remedi in Section 6.0 of the Proposed Plan, which was issued on July 17, 1 documents on which the preferred alternative was based were placed administrative record for review. The administrative record is a c documents considered by the USAF while choosing the remedial action It is available to the public at the following location:

Air Force Base Conversion Agency
5100 Texas Road
Limestone, ME 04751
(207) 328-7109

The purpose of this Responsiveness Summary is to document USAF resp questions and comments raised during the public comment period rega proposed OU 1 preferred alternative. The USAF considered all comme document before finalizing the preferred remedy for OU 1.

This Responsiveness Summary is organized into the following section

1.0 Overview of the Preferred Alternative. This section briefly o preferred alternative presented in the Proposed Plan for OU 1.

2.0 Background on Community Involvement and Concerns. This sectio a brief history of community interest in OU 1 and concerns reg areas.

3.0 Summary of Comments Received During the Public Comment Period USAF Responses. This section summarizes and provides the USAF responses to all written and oral comments received from the p the public comment period.

1.0 OVERVIEW OF THE PREFERRED ALTERNATIVE

The following paragraphs outline the preferred alternative presente Plan OU 1.

Based on the results of the RI, no further remedial action under CE considered necessary for OU 1 at LAFB.

Areas A through F: In 1994, removal actions were conducted for the radiological USTs and the contents of the former waste disposal tre Completion of these removal actions has eliminated the need for any remedial action at Areas A through F.

Area G: The contamination detected at Area G is primarily attribut leaking UST and possibly the fuel oil pipeline. The tanks were rep was abandoned. Because the release involved only petroleum product will address the petroleum contamination as a non-CERCLA action und UST regulations.

Section 12 of the Maine UST regulations (06-096 CMR 691) outlines r for leak investigation, response, and corrective action. Many of t response and investigation have been met during the course of repla 216 USTs and conducting the RI. Further response at Area G, in acc Section 12 requirements, potentially includes soil remediation, gro treatment, and monitoring.

If during the course of the UST remedial response, CERCLA-regulated identified at concentrations that pose risk to human health or the Area G of OU 1 will be managed under the IRP and CERCLA.

2.0 BACKGROUND ON COMMUNITY INVOLVEMENT AND CONCERNS

Throughout LAFB's history, the community has been involved in base USAF, USEPA, and MEDEP have kept the community and other interested apprised of LAFB IRP activities through informational meetings, fac releases, public meetings, site tours, and open houses.

In addition to these activities, during the course of IRP activitie have been regular meetings of the Restoration Advisory Board (RAB) Technical Review Committee). The RAB, chaired by the USAF and a re of the community, is composed of representatives of the USEPA, MEDE community, and local officials. The purpose of the RAB meetings ha ensure clear communication with the public, timely transfer of info opportunity for public comment.

A Federal Facilities Agreement (FFA) between USEPA Region I, MEDEP, USAF, signed January 30, 1991, governs environmental activities bei LAFB. The FFA provides the framework for addressing environmental associated with past and present activities so that appropriate inv remedial actions are implemented to protect human health, welfare, environment. Since the signing of this agreement, LAFB was placed Base Closure List and closed in September 1994. The FFA was amende December 1993 to address base closure-related issues such as transf property. The FFA was further modified in January 1995 to allow Re Managers to make minor modifications to the FFA, such as schedule a removal of petroleum-contaminated sites from the agreement.

The framework for the USAF's approach to community involvement is t Community Relations Plan (CRP), which was released in August 1991 a subsequently revised in May 1995. The CRP outlines the USAF's prog addressing community concerns and keeping citizen informed and invo remedial activities. To ensure the public was informed about the I USAF held three public information meetings in the towns of Limesto and Fort Fairfield in February and March, 1993. The purpose of the to introduce the IRP program and respond to any questions from the

Documentation of the reports, memoranda, and correspondence that ar for IRP remedial response decisions are kept in an Administrative R

Administrative Record is open and available for public review at th Conversion Agency Office, 5100 Texas Road, Limestone, Maine.

The following is a summary of the activities the USAF has undertake public informed and involved regarding the remedial response at OU

> On June 2, 1994, a RAB meeting was held to discuss the resul 1 investigations and the approach for conducting the UST and waste disposal trench removal action.
>
> An IRP Fact Sheet, explaining activities planned for OU 1, w

1994.

The USAF published a notice and brief discussion of the prop action in the Aroostook Republican on July 6, 1994 and the B News on July 7, 1994.

From July 11 through August 10, 1994, the USAF held a 30-day comment period to accept public input on the Action Memorand the proposed removal action, and on any other OU 1 documents Administrative Record. On July 28, 1994, USAF personnel and representatives held a public meeting to discuss the Action to accept oral comments.

During the removal action, the USAF invited the local press trench removal activities. Information regarding both the t tank removals was made available to representatives of local

The USAF published a notice and brief analysis of the Propos Bangor Daily News, Aroostook Republican, Fort Fairfield Revi Presque Isle Maine Star-Herald on July 12, 1995, recommendin under CERCLA as the preferred alternative for OU 1.

On July 17, 1995, the Proposed Plan for OU 1 was made availa review at the Air Force Base Conversion Agency Office, 5100 Limestone, Maine.

From July 17 through August 16, 1995, the USAF held a 30-day comment period to accept public input on the recommendations

RI/Baseline Risk Assessment and the No Action preferred alte presented in the Proposed Plan, and on any other documents i Administrative Record. On August 2, 1995, USAF personnel an representatives held a public meeting and hearing to discuss Proposed Plan. During the public meeting, the USAF answered informally from the public. Immediately following the publi public hearing was held to accept oral comments. Based on t comments, the public is in agreement regarding the preferred OU 1 as presented in the Proposed Plan.

3.0 SUMMARY OF COMMENTS RECEIVED DURING THE PUBLIC COMMENT PERIOD AND USAF RESPONSES

This Responsiveness Summary addresses comments received by the USAF USEPA during the public comment period from July 17 to August 16, 1 to the Proposed Plan for OU 1. The only comments received were tho in writing from a RAB member. The comments and corresponding respo included herein.

1. Comment: The commenter asked what was the purpose of the fiv radiological USTs attached to weapon maintenance facilities.

   Response: The purpose of the five radiological USTs was to r contain potentially radioactive liquids in the event of a rel buildings. Further information can be obtained from the OU 1 Investigation Report which is part of the Administrative Reco

2. Comment: The commenter asked what radioactive isotopes were transported to these radiological USTs.

   Response: The radiological USTs at Areas A and F supported B and 232, respectively. Strategic weapons components were rep installed and inspected within these buildings, with the UST event of a release of radioactive materials. A radioactive r buildings could have potentially been composed of enriched ur plutonium, americium, or tritium. There were no documented r these tanks, which is supported by the analysis of the tank l and scrape samples. Further information can be obtained from Remedial Investigation Report which is part of the Administra

   The remaining three radiological USTs at Areas B, C, and D su "short igloos" where the tritium containers were stored. The contained floor drains which were connected to the USTs to re washdown liquids in the event of a tritium release. There we documented releases to these radiological USTs, which is supp analysis of the tank liquids.

3. Comment: The commenter asked if there are no documents showi of any radioactive isotopes into these radiological USTs, why tested.

   Response: The tanks were sampled because they did contain li documentation on the origin of the liquid could not be locate that the tanks did not contain chemical or radioactive contam sediments, interior scrape samples, and soil samples from ben were collected and analyzed for the target radioisotopes for prior to their removal in 1994. Further information can be o OU 1 Remedial Investigation Report which is part of the Admin Record.

4. Comment: The commenter asked if any radioactive isotopes had in the UST, would it have been necessary to have disposed of Repository in Utah.

   Response: Depending on the levels and radioisotopes found, i been necessary to have disposed of these USTs in Utah. Howev the lack of contamination in the tanks, they were simply disp metal.

5. Comment: The commenter asked why tritium is found all over t WSA if tritium is a very light gas and, when released either purposeful venting, should have risen into the Stratosphere a

   Response: Tritium is found in background due to atmospheric testing in the 1960s, more recently from nuclear power plant naturally occurring interactions with cosmic rays and gases i atmosphere. The tritium detections in the University of Main analyses indicated levels of tritium at the Weapons Storage A which are consistent with background levels. Further informa obtained from the OU 1 Remedial Investigation Report which is Administrative Record.

6. Comment: The commenter asked why are the areas of tritium co at the WSA not related to the weapon maintenance facilities.

   Response: As discussed, the tritium detected at the WSA is a levels with normal local variation. There are no significant concentration" at the WSA.

7. Comment: The commenter asked why tritium radiation backgroun established at Loring, since a great deal of effort was made background radiation of certain isotopes around the Loring WS

   Response: Tritium background was not established due to the detected and because of tritium's relatively low health risks detections from within the WSA were what would be expected in Detections of tritium in groundwater and surface water were a USEPA's drinking water standard for tritium.

8. Comment: The commenter asked whether the southern area was m in the plan, with reference to tritium, around the Nuclear Po Wiscasset.

   Response: No reference to the "southern area" was made in th Plan. However, in the University of Maine report, there is a samples collected from Southern Maine. In 1972, tritium anal performed around the "then being constructed" nuclear power p Wiscasset (which is in Southern Maine). The data were collec power plant receiving any nuclear fuel to establish a baselin future monitoring data could be compared.

9. Comment: The commenter asked why tritium would be defined as contaminant at Area D, and, when found at other areas, not be as a contaminant.

Response: Tritium is acknowledged as a potential contaminant C and Area D, based on known site history.

10. Comment: The commenter asked why there is such a reluctance acknowledge tritium as a radioactive substance throughout thi

Response: It was certainly not the intent of the Air Force t to address tritium. Tritium has been carefully addressed thr process by the USAF, the University of Maine, the MEDEP, and

SECTION 3

Tritium was identified as one of the WSA's target radioactive therefore was included in analyses of OU 1 environmental samp is no detailed discussion of tritium, in particular, because the Proposed Plan is to present the Air Force's preferred alt general overview of the IRP activities conducted to date, and of the radiological investigation did not identify tritium at occurring levels.

11. Comment: The commenter asked whether the following is a corr paraphrase of the last paragraph on Pages 4-5 and 4-6:

(1) Background radiation at Loring and its Weapon Storage Ar may pose a natural health risk.

(2) Background radiation at Loring and its WSA is lower than throughout the United States.

(3) That even though the WSA at Loring is contaminated with grade radioactive isotopes, tritium, the human health ri radiation is still lower than risk typically associated occurring radiation throughout the United States.

Response: There are several inaccuracies in this interpretat referenced paragraph. To clarify, risk calculations were per concentrations of naturally occurring radiation throughout th (2) background concentrations of radioactive isotopes establi and (3) concentrations of radioactive isotopes detected at th associated with background radiation at Loring and at the WSA than risks associated with published naturally occurring leve throughout the U.S. Further information can be obtained from Remedial Investigation Report which is part of the Administra

These comparisons were made to illustrate that while the huma calculated for the radioactive isotopes at the WSA are higher USEPA target risk range (1x10-4 to 1x10-6), naturally occurri has a risk higher than the USEPA target risk level. Followin

removal action, the risks associated with radioactivity at th
consistent with naturally occurring radiation.

W0049530APP.B

The statement that "Loring is contaminated with weapons-grade
isotope, tritium", is somewhat misleading. Tritium is tritiu
included in a weapon or a result of natural reactions in the
the levels of tritium detected are consistent with background

W0049530APP.B

LETTERS OF CONCURRENCE

(TO BE INCLUDED IN ROD FOR SIGNATURE)

W0049530APP.B

STATE OF MAINE

<IMG SRC 0195105C> DEPARTMENT OF ENVIRONMENTAL PROTECTION

ANGUS S. KING, JR.
GOVERNOR

August 16, 1995

Mr. Peter Forbes
Air Force Base Conversion Agency
Operation Location "M"
RR # 1 Box 1719
Limestone, Maine 04750

RE: Loring Air Force Base Superfund Site, Maine

Dear Mr. Forbes:

The Maine Department of Environmental Protection (MEDEP) has 1995 Draft Record of Decision (ROD) regarding Operable Unit 1 (OU 1 Base Superfund Site located in Limestone, Maine.

Based on that draft, the MEDEP concurs with the Air Force's d under CERCLA is necessary to address the contamination at OU 1. Th with the following recommendations:

1. That Areas A through F of OU1 be removed from the U.S. Air Forc response under Installation Restoration Program.

2. That Area G be redesignated a Non-CERCLA site to be managed in State of Maine regulations for underground storage tanks.

Clean Up Levels

The remedial alternative selected for the site must achieve g contamination at OU 1. Clean-up goals for Area G have been set for and groundwater based either on background concentration, analytica calculation.

Compounds and elements for which remedial goals have been set through 10-6 of this ROD.

Description of No Action Alternative

The following paragraph describes the no action remedial alte Operable Unit 1 at Loring:

Serving Maine People & Protecting Their Environmen

AUGUSTA
STATE HOUSE STATION 17
1235 CENTRAL DRIVE, SKYWAY PARK
AUGUSTA, MAINE 04333-0017
(207) 287-7688 FAX: (207) 287-7826

PORTLAND
ISLE
312 CANCO ROAD
PORTLAND, ME 041
PRESQUE ISLE, ME 04769
(207) 822-6300 F
FAX: (207) 941-4584 (207) 764-0477 FAX: (207) 764-1507
OFFICE LOCATED AT: RAY BUILDING, HOSPITAL STREET

Sampling conducted after the response actions were completed through F of OU 1, confirmed that essentially no radiological or no above background concentrations, remained at the former UST or disp Analysis of groundwater sampled from monitoring wells installed dow disposal trenches did not consistently detect radiological or non-r above MCLs or MEGs, other than that attributable to background vari

Based on these results, no further remedial action under CERC necessary for OU1 at LAFB and no further remedial action under Stat

necessary for Areas A through F of OU1. Sampling has shown fuel-re soils and groundwater at Area G. It is, therefore, recommended tha be removed from the IRP for closure of federal facilities. It is f also be removed from the IRP and be redesignated as a non-CERCLA si remediated in accordance with the Maine UST Regulations. Because n contamination, attributable to the LLRWDS, remains on site, additio reviews are not recommended.

The State's concurrence in the selected remedy, as described construed as the State's concurrence with any conclusions of law or be set forth in the Record of Decision (for OU1). The State reserv challenge any such finding of fact or conclusion of law in any othe

This concurrence is based upon the State's understanding that to participate in the Federal Facilities Agreement and in the revie design and monitoring plans.

The MEDEP looks forward to working with the Department of the USEPA to resolve the environmental problems posed by this site. If information, do not hesitate to contact myself or members of my sta

Sincerely,

Edward Sullivan, Commissioner
Department of Environmental Protection

pc: Mark Hyland, MEDEP
Mike Nalipinski, EPA
Hank Lowman, BCA

COMSUPER/dlb